

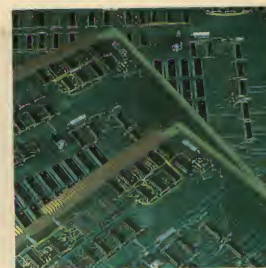
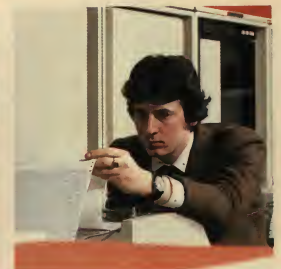
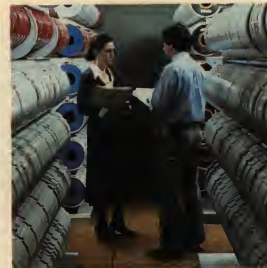
Prime Computer, Inc.

PRIME

DOC7323-192L

System Operator's Guide
Volume I

Revision 19.2



System Operator's Guide

Volume I

DOC7323-192

Second Edition

by

**James Craig Burley
and
Roberta Beeson**

This guide documents the software operation of the Prime Computer and its supporting systems and utilities as implemented at Master Disk Revision Level 19.2 (Rev. 19.2).

**Prime Computer, Inc.
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Second Edition	May 1983	DOC7323-192	19.2

This edition has been completely revised. The revisions reflect both new and changed technical features. Other changes to the book clarify or amplify information from previous editions. Because this entire edition has been so heavily revised, change bars have been used only to indicate software changes at Revisions 19.1 and 19.2.

SUGGESTION BOX

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This applies to the 9950, the 2250, and to all 50 series processors manufactured after October 1, 1983:

WARNING

This equipment generates and uses radio frequency energy and if not installed and used properly, i.e., in strict accordance with the installation and instruction manual, may cause harmful interference to radio communications. It has been tested and found to comply with the limits for a Class A computing device pursuant to Subpart J of Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference when operated in a commercial environment.

Operation of this equipment in a residential area is likely to cause interference in which case the user at his own expense will be required to take whatever measures may be required to correct the interference.

This applies to all other processors described in this book:

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About This Book

The System Operator's Guide provides guidelines for the successful daily operation of a Prime computer. In order to use this information most effectively, the reader should be familiar with the topics covered in the Prime User's Guide.

The System Operator's Guide is issued in a two-volume set. Volume I is primarily concerned with hardware operations, such as system startup and shutdown. Volume II covers system maintenance tasks, such as monitoring system resources and performing backups and restorations. It provides guidelines for performing these tasks and describes the utilities used to accomplish them.

HARDWARE OPERATIONS

This book, Volume I of the System Operator's Guide, is divided into seven parts and an appendix section. Its organization reflects the differences in hardware operations for various models of Prime computers.

Parts I and VII contain information that applies to any Prime computer system.

- Part I provides an overview of system organization and operation.
- Part VII discusses startup and shutdown procedures common to all Prime systems.

Parts II to VI each contain information that applies to a particular system or group of systems. The systems discussed in these parts are:

- Part II: The Prime 9950
- Part III: The Prime 2250
- Part IV: Most 50 series systems, including the 250-II, 550-II, 750, 250, 450, 550, and 650
- Part V: The Prime 850
- Part VI: The Prime 400 family, including the 350, 400, and 500

Each of these parts contains four chapters that cover the following topics:

- Equipment operation
- System startup procedures
- Halt and hang handling procedures
- System shutdown procedures

The appendixes for Volume I provide further details on the following subjects:

- Virtual Control Panel (VCP) commands
- Diagnostic Processor messages for the 9950
- Remote diagnostics for the 9950
- Control Panel (CP) operation for the 400 family
- Bootstraps
- Uninterruptible Power Supply (UPS) for the 9950

SYSTEM SOFTWARE AND MAINTENANCE

Volume II of the System Operator's Guide contains information on the following topics:

- PRIMOS
- The PRIMOS file system
- The user community
- System resources

- System monitoring
- Disk formatting
- Performing backups
- Restoring data from backups
- Repairing disk partitions
- Monitoring print and plot requests
- Monitoring batch jobs
- Monitoring file transfer requests
- PRIMOS commands
- PRIMOS II commands

OTHER PRIME DOCUMENTATION YOU SHOULD KNOW ABOUT

Several Prime documents are mentioned in this text. For information on ordering these books, see page ii.

Frequent reference is made to the System Administrator's Guide, DOC5037-190. This book contains information about system building, resource allocation, and system security. This book has two updates, UPD5037-191 and UPD5037-192.

Two basic references necessary to any user of a Prime system are the New User's Guide to EDITOR and RUNOFF, FDR3104-101, (with updates at Rev. 18, COR3104-001, and Rev. 19, COR3104-002) which provides information on Prime's text editor and formatter; and the Prime User's Guide, DOC4130-190, which contains information on PRIMOS (the operating system of every Prime computer), Prime's file system, utilities, compilers, and subroutine libraries.

The Magnetic Tape User's Guide, DOC5027-183, and its two update packages, UPD5027-184 and UPD5027-190, provide a complete description of working with Prime's magnetic tape software.

The PRIMOS Commands Reference Guide, FDR3108-190, is a dictionary of PRIMOS commands.

The PRIMENET Guide, DOC3710-190, explains PRIMENET, Prime's networking system.

The Prime 50 Series Technical Summary, DOC6904-191, describes the features of the 50 Series systems, including their advanced architecture concepts, and the software and hardware products they support.

If you are interested in writing programs to help run your system, the CPL User's Guide, DOC4302-190, will be of particular interest to you. This book describes Prime's Command Procedure Language (CPL), a powerful and flexible tool for program development. Additionally, you may want one or more of the language reference guides, the Subroutines Reference Guide, DOC3621-190, and the SEG and LOAD Reference Guide, DOC3524-192.

PRIME DOCUMENTATION CONVENTIONS

The following conventions are used in command formats, statement formats, and in examples throughout this document. Examples illustrate the uses of these commands and statements in typical applications. Terminal input may be entered in either uppercase or lowercase.

<u>Convention</u>	<u>Explanation</u>	<u>Example</u>
UPPERCASE	In command formats, words in uppercase indicate the actual names of commands, statements, and keywords. They can be entered in either uppercase or lowercase.	SLIST
lowercase	In command formats, words in lowercase indicate items for which the user must substitute a suitable value.	LOGIN user-id
abbreviations	If a command or statement has an abbreviation, it is indicated by underlining. In cases where the command or directive itself contains an underscore, the abbreviation is shown below the full name, and the name and abbreviation are placed within braces.	<u>LOGOUT</u> { SET_QUOTA SQ }
<u>underlining</u> in examples	In examples, user input is underlined but system prompts and output are not.	OK, <u>RESUME MY_PROG</u> This is the output of MY_PROG.CPL OK,

Brackets

[]

Brackets enclose a list of two or more optional items. Choose none, one, or more of these items.

SPOOL [-LIST
-CANCEL]

Braces

{ }

Braces enclose a list of items. Choose one and only one of these items.

CLOSE { filename
ALL }

Ellipsis

...

An ellipsis indicates that the preceding item may be repeated.

item-x[,item-y]...

Parentheses

()

In command or statement formats, parentheses must be entered exactly as shown.

DIM array (row,col)

Hyphen

-

Wherever a hyphen appears as the first letter of an option, it is a required part of that option.

SPOOL -LIST

10/2/77

10/2/77

10/2/77

10/2/77

10/2/77

10/2/77

10/2/77

10/2/77

10/2/77

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10/2/77

PART I

Concepts

1777

Continued

1

Working With Prime Computers

INTRODUCTION

This chapter discusses the various components of a Prime computer system and some basic concepts of operating such a system.

The system has three general areas of concern for the operator:

- The system
- The computer room
- The logbook

The system resides in a computer room for which the environment is strictly controlled by air-conditioning units and other related equipment. The logbook is a repository for records of system- and computer room-related incidents.

The System

The term system refers collectively to the following components:

- Central Processing Unit (CPU)
- Main memory
- Disk storage

- Diagnostic Processor
- Virtual Control Panel (VCP)
- Operating system (PRIMOS or PRIMOS II)
- Programs
- Peripherals

All Prime computer systems include all of the above components. On early Prime systems (the 350, 400, and 500), the Virtual Control Panel (VCP) is not available; instead, a physical Control Panel (CP) is provided. On recent Prime systems (the 2250 and 9950), a Diagnostic Processor replaces the VCP. This Diagnostic Processor performs all of the functions of the VCP and offers additional functionality as well.

The individual components of a Prime system are discussed later in this chapter, starting with The Central Processing Unit (CPU).

General Monitoring of the Computer Room

The Prime 2250 is designed to operate in an office environment. All other Prime systems require a more tightly controlled environment in which to operate. Usually, this environment is provided in the computer room.

Operators generally monitor all aspects of activity in the computer room, making sure that hardware functions properly to serve the user community. Particular attention is paid to:

- Air-conditioning units, to maintain the temperature and humidity of the computer room within acceptable limits.
- The CPU, to keep the computer operational at all times
- Disk drives, to keep them online and functioning normally.
- Tape drives, which must be cleaned on a regular basis, to ensure proper operation.
- Printers, which must be cleaned on a regular basis and must have their paper and ribbons replaced frequently, to provide legible printouts for users.
- Modems and multiplex units, to keep data moving throughout the network.

Specific tasks in the computer room will be defined by the System Administrator.

The System Logbook

The System Administrator will establish a logbook for each system in the computer room. Although the precise design of the logbook will vary from one computer facility to another, logbooks generally contain records of all events affecting system operation. Operators maintain the logbooks. Therefore, you should learn your site's logbook procedures as soon as possible.

A logbook should contain sufficient information about system operation and history to allow a thorough analysis of any unusual or undesirable occurrences. Such events include system crashes, hardware changes, operator errors, or external happenings such as power failures. Logbook records should be adequately detailed so that the administrator or operator can restore all or part of the system to normal status. In extreme cases, the logbook may serve as a reference for a system analyst. Thus, as a general rule: When in doubt, enter it in the logbook.

The logbook is also used to record significant system conditions or changes. These include hardware configuration, disk partitions, system halts, backups, and so on. By recording such events, the logbook allows reconstruction of the system history.

Complete logbook procedure is detailed in Volume II of this book. In all cases, two rules should be followed:

- All entries should record time and date (including year).
- All entries should be signed. The System Administrator or System Analyst will then be able to check with the operator for clarification or additional information.

THE CENTRAL PROCESSING UNIT (CPU)

A Central Processing Unit (CPU) is a machine that has the ability to execute programs very quickly. These programs are not contained in the CPU itself but are stored in main memory instead.

On Prime systems, the CPU consists of two or more boards in the main system cabinet. The Prime 9950 has these boards stored in a single box.

To provide a means for communication between the CPU and the rest of the system, all Prime systems have a backplane. The CPU, memory, and input/output controller boards all plug into this backplane, so that they may communicate with each other.

MAIN MEMORY

Whereas the CPU can execute a program very quickly, the program and its data are stored in main memory. Main memory is very fast — data can be read from and written to main memory in extremely short amounts of time. Speed is important, because the CPU constantly reads the next instruction of the running program from main memory. If main memory is slower than the CPU, the CPU will not be able to run at top speed.

Cache Memory

On all Prime systems, main memory includes a special portion of memory known as cache. Cache memory is even faster than main memory. For more information on cache, see the Prime 50 Series Technical Summary or the System Architecture Guide.

Drawbacks of Main Memory

As fast as main memory is, it has two basic problems. First, the information in main memory is lost when power is turned off. Second, main memory is expensive, so it is important to use it in the most efficient manner possible.

To solve these two problems, another form of memory, online storage, is used.

ONLINE STORAGE — DISK MEMORY

To provide a storage area for data that must be maintained even when system power is turned off, and to allow large volumes of data storage, all Prime systems use online storage, or disks. Disks store much larger quantities of data than main memory can, and they retain the information whether power is turned on or off.

However, the CPU can execute only programs that are in main memory. The operating system (PRIMOS or PRIMOS II) provides the facility whereby users are able to run programs and manipulate files that reside on disk.

The operating system reads programs and data into memory from disk when they are to execute. It also writes changes or additions to the program or data back out onto disk during execution, if the program so requests. In fact, PRIMOS completely manages the juggling of programs and data between disk and main memory, so that users need not be concerned with the transfer, or even be aware of it.

Virtual Memory

PRIMOS uses virtual memory to run programs. This technique allows the computer to run a program that is larger than main memory. Portions of the program that are not being used may reside in main memory, or may be moved out of main memory onto disk storage. This operation is performed automatically by PRIMOS and is referred to as paging. Even a program that fits into main memory if run by itself will be paged by PRIMOS when other users are also running programs.

For more information on virtual memory, see the Prime 50 Series Technical Summary.

Disk Preparation

Unlike memory, disk storage must be prepared before it is used. This preparation is called formatting and is sometimes performed by the operator, using a PRIMOS utility called MAKE. Information on MAKE will be found in Volume II of this book.

Varieties of Disks

Prime systems support three basic types of disk:

- Storage Module Disks (SMD)
- Cartridge Module Devices (CMD)
- Fixed-Media Disks (FMD)

Storage Module Disks (SMD) consist of two units — the disk drive and the disk pack. The disk pack is a covered stack of disk platters, and contains the actual data. This disk pack is mounted in the disk drive so that the data may be accessed and changed (read and written). The disk drive contains all of the circuitry and equipment to manipulate data on the disk pack at the request of the CPU. Because the disk pack may be removed from the disk drive, vast amounts of data can be stored on many disk packs, which can then be alternated among a few drives.

Cartridge Module Devices (CMD) also include a removable pack. However, the disk drive for a CMD also includes one or more non-removable platters. CMDs generally store less data than either SMDs or FMDs, because they have fewer platters.

The Fixed-Media Disk (FMD) -- also referred to as a Winchester disk, consists essentially of one unit -- the disk drive. The platters within these disk drives are not removable. By permanently sealing the disk platters into the disk drive, FMDs can store larger amounts of data than SMD or CMD disks can store in the same amount of space.

In addition to these three varieties of disks, PRIMOS also supports floppy disks, also referred to as diskettes. However, this support is limited to file system access and does not include virtual memory support.

For complete information on disks supported by PRIMOS, see Volume II of this book.

Drawbacks of Online Storage

Two major drawbacks of online storage are that it is slower and more susceptible to damage than main memory. Another drawback is that information on the disk can be lost accidentally, such as when a user mistakenly deletes a file.

To solve the problem of the slower disk speed, PRIMOS performs certain optimizations to keep disk access to a minimum. To solve the problems of susceptibility to damage and accidental loss, PRIMOS provides a facility whereby data may be backed up onto off-line storage media such as magnetic tape or other disks.

Speed of Data Access: Although disk storage allows larger volumes of data to be stored less expensively than main memory, and it retains the information whether power is turned on or off, it is slower than main memory. PRIMOS has several facilities that reduce disk access under most circumstances, resulting in greater overall performance.

Susceptibility to Damage: To provide the high density of data storage, and to allow data access to be as fast as possible, disks are designed and constructed using extremely fine tolerances. For example, a human hair is several times wider than the distance between the head and platter of a disk. In addition, the disk pack itself rotates at high speeds (3600 rpm).

As a result of this precise engineering, even a minor disruption of the disk head or platter can cause the entire disk pack and drive to be severely damaged. When this happens, the data on the disk is often destroyed.

Magnetic tape is often used as a backup medium, since the tolerances involved allow larger margins of error. In addition, tape itself is pliable and light, so a disruption will rarely result in the loss of an entire tape or tape drive.

Accidental Loss: Because online storage is made so convenient by PRIMOS and its file system, it is equally convenient for a user to delete files and directories. Therefore, users will occasionally perform unintentional deletions, or will overwrite files containing important information.

By performing system backups, offline copies of user files and directories are generated. These copies are not convenient to access, and this prevents a user from accidentally deleting data on backup copies. Backup copies are usually made on magnetic tape or removable disk packs.

THE DIAGNOSTIC PROCESSOR

The Prime 9950 and 2250 each contain a Diagnostic Processor. This device monitors the CPU and main memory, and it allows the operator to communicate with various parts of the system. The Diagnostic Processor on the Prime 9950 is more sophisticated than the one on the Prime 2250. Complete information on the 9950 Diagnostic Processor can be found in Part II and in Appendixes A, B, C, and F.

Both the 9950 and the 2250 Diagnostic Processors include a Virtual Control Panel (VCP). For the operator, the VCP is an important interface to the system. Most Prime systems that do not have a Diagnostic Processor do have a VCP. Those Prime systems that have neither employ a Control Panel (CP). All three devices allow the operator to start up, shut down, and directly control the system (including the CPU).

THE VIRTUAL CONTROL PANEL (VCP)

The Virtual Control Panel (VCP) is available on all Prime systems except the Prime 350, 400, and 500. These systems have older Control Panels (CP) instead.

A VCP is a small computer that controls the CPU. Although the VCP contains its own Central Processing Unit, it is much smaller than the system CPU discussed earlier.

The VCP can operate even when the system CPU is not running. Therefore, the VCP can be used to start, stop, or diagnose the CPU.

The VCP can be thought of as a tugboat, and the CPU as a large steamer. The VCP prepares the CPU to run. Once the CPU is running, the VCP is

no longer required unless the CPU halts or hangs. However, the VCP is available for use at all times, whether the CPU is running or not.

The VCP is connected to the supervisor terminal. From the supervisor terminal, the operator communicates with the VCP, which in turn controls the CPU or communicates with the operating system. Because of the power the VCP operator wields, the supervisor terminal is normally restricted to key personnel, such as the operations staff.

Function of the VCP

The VCP allows the operator to monitor and control the CPU, independent of the current operating system in use. For example, the operator can use the VCP to direct the CPU to halt. All other users of the system communicate with the operating system only. The operating system prevents any user from disrupting the activities of any other users. Therefore, under normal circumstances, users cannot forcibly halt system operation.

The VCP also allows the operator to communicate with the operating system. This communication is recognized by the operating system as being between itself and the operator. Both the PRIMOS and PRIMOS II operating systems grant the VCP operator special privileges during certain system operations. Under PRIMOS II, only the VCP operator may enter commands and view output. Under PRIMOS, the VCP operator may perform privileged functions, such as setting the system date and time, sending broadcast messages, shutting down the operating system, and logging out users.

On the Prime 9950 and 2250, the Diagnostic Processor VCP allows the operator to communicate with PRIMOS not only as an operator but also as a normal user. This is useful when the operator is in fact a user who is also responsible for system operation.

Differences Between VCPs on Prime Systems

The VCP available on the 50 series and the 850 is Prime's original VCP. The VCP implemented on the Prime 2250 as part of the Diagnostic Processor is similar to the 50 series VCP but has some extra commands and capabilities.

The VCP implemented on the Prime 9950 as part of its Diagnostic Processor is based on the 50 series VCP, but it has far more commands and capabilities than its predecessors. The Diagnostic Processor has a floppy disk from which it loads programs and data into the Diagnostic Processor or CPU memory. It has a battery-backup clock to keep track of the date and time. Its special environmental sensors can recognize a temperature exceeding operating limits for the CPU and will shut down the system automatically.

Complete information on VCP commands, including information on which commands work on particular Prime systems, is found in Appendix A.

THE OPERATING SYSTEMS

An operating system is a large program that coordinates the CPU, memory, disks, and peripherals. For example, it is PRIMOS that recognizes a command issued by a user on a terminal, searches for the requested program on the disk, loads that program into memory, and instructs the CPU to execute it. The operating system is also used by the program to output data to the terminal from which the program was invoked.

Time-Sharing

Most operating systems provide time-sharing. This means that they parcel out shares of time to many different users. A time-sharing operating system allows many users to use the system at once, even though only one CPU is present and only one program can run at a time.

Because of the high execution speed the CPU provides, users generally do not notice the time the CPU spends on other users. Thus, time-sharing gives each user the impression that he or she has the computer to him- or herself.

(For information on how time-sharing works under PRIMOS, see the Prime 50 Series Technical Summary.)

PRIMOS and PRIMOS II

Prime systems contain two operating systems — PRIMOS and PRIMOS II. PRIMOS is the more powerful of the two. Your system will normally run PRIMOS. PRIMOS supports time-sharing, so many users can use the system at one time. It also uses the virtual memory technique discussed earlier. PRIMOS II is used when starting up PRIMOS, or when PRIMOS cannot be run. Unlike PRIMOS, PRIMOS II does not support time-sharing, so only one program can be run at a time, and only from the supervisor terminal.

All of the commands typed at user terminals are processed by PRIMOS before they take effect. When using the supervisor terminal, commands are processed by PRIMOS only when the VCP is set to communicate with PRIMOS. (If your system has a control panel, the supervisor terminal is always set to communicate with PRIMOS.)

For more information on PRIMOS and PRIMOS II, see Volume II of this book.

PRIMOS Security

PRIMOS is responsible for preventing one user from affecting the progress of another user unless the first user has sufficient privilege. For example, if user JANE is editing a file using ED, user FRED cannot issue an editor command for JANE's editing session. If user FRED starts editing a different file, the operating system ensures that the two edit sessions are kept separate, so that they do not conflict with each other. In fact, user JANE may be completely unaware that user FRED is also editing a file, and vice versa.

The most privileged user in PRIMOS is the system operator. This privilege is primarily gained by using the supervisor terminal. PRIMOS recognizes the supervisor terminal user as a special user, named SYSTEM. User SYSTEM is always logged in, and is user number 1. Other users on the system have higher user numbers. When using the supervisor terminal, the operator can change the PRIMOS system configuration, log out other users, send messages to all users, and do other useful things that normal users are not permitted to do.

Another privileged user is the System Administrator. The System Administrator has the ability to add usernames to the system, change user passwords, access all files on disk storage, and so on. Complete information on the privileges of a System Administrator is found in the System Administrator's Guide.

PRIMOS II -- Why Use It?

Compared to PRIMOS, PRIMOS II is a primitive operating system. It is not time-shared, so only one user can use it at a time. In fact, it must be used from the supervisor terminal, as PRIMOS II does not communicate with user terminals. In addition, PRIMOS is a virtual memory operating system. PRIMOS II does not support virtual memory, and it is incapable of using all of the main memory on a system. In fact, it only uses 128KB of main memory. Most systems have 512KB, 1024KB, or more, but this extra memory is not used by PRIMOS II.

However, there are times when PRIMOS II is needed. These are:

- When starting up PRIMOS.
- When PRIMOS cannot be started up.
- When some activity to be performed is not allowed by PRIMOS.

Starting Up PRIMOS: During system startup, PRIMOS II is run before PRIMOS. The program that starts up PRIMOS needs an operating system in which to run. Since PRIMOS is not yet started, it must use PRIMOS II.

PRIMOS Cannot Be Started Up: There are times when PRIMOS cannot be started up. This happens when one of the many system resources required by PRIMOS to operate is unavailable. PRIMOS II can be started

up even when no disks are available, because it can be booted from tape. This is not possible with PRIMOS. Therefore, if system disk storage is unavailable or lost, PRIMOS II can be used to restore the disk storage sufficiently so that PRIMOS can be brought up again.

Activities Not Permitted by PRIMOS: There are certain system activities that are not permitted by PRIMOS. For example, PRIMOS will not allow you to perform a disk-to-disk backup of your command device (the disk on which system commands reside). To perform this operation, PRIMOS II is used.

PRIMOS II System Security

PRIMOS II implements very little system security. However, since PRIMOS II can only be used from the supervisor terminal, no security is needed. Any user who can access the supervisor terminal has operator privileges under both PRIMOS and PRIMOS II.

In fact, one of the reasons PRIMOS II is useful is that system operations can be carried out with no fear of interference from any other user, since user terminals are inoperative unless PRIMOS is running.

PROGRAMS

The major purpose of an operating system is to execute programs. Some of these programs, such as DBMS/QUERY and OAS, are provided by Prime. Many programs are written by the users of Prime systems. PRIMOS provides a flexible environment in which users may develop application programs. The system operator monitors and controls the ability of PRIMOS to carry out instructions and execute programs based on user requests.

Some parts of PRIMOS may also be considered programs. For example, the COPY command is a PRIMOS command, and it is also a separate program.

THE PERIPHERALS

Strictly speaking, disks and the VCP are peripherals. However, they are considered an integral part of the PRIMOS system, so they were discussed as components of the system, above.

Peripherals include the following devices:

- User terminals (to a maximum of 128)
- Magnetic tape drives (to a maximum of 8)

- Letter quality printers
- Parallel printers (to a maximum of 4)
- Serial line printers (to a maximum of 4)
- Plotters
- CAD/CAM work stations
- Synchronous communications boards (to a maximum of 2)
- Paper tape reader/punches
- Card reader/punches (to a maximum of 4)
- A Prime Node Controller (for RINGNET)

Operation of these peripherals from within PRIMOS is discussed in Volume II of this book. To learn about physical operation of these devices, and for an in-depth view of a specific piece of hardware, see the appropriate hardware manual.

THE BOOTSTRAPPING PROCESS

When you first turn on the power to a Prime CPU, the computer's main memory is empty. To make the CPU useful, a program (preferably an operating system) must be loaded into memory from an external device such as a disk. On the Prime 9950 and 2250, this loading is performed automatically when the system power is turned on. On other Prime systems, the operator must initiate this.

This loading process (called "booting the system") involves two major steps:

1. Either automatically (as with the 9950 and 2250), by means of the BOOT command (for a computer with a Virtual Control Panel), or by using the control panel rotary switch (for a computer without a VCP), you load a short program called a "bootstrap" from a special part of computer memory. On the Prime 9950, this memory is located on the floppy disks used by the Diagnostic Processor. On other Prime machines, this memory is located on Programmable Read-Only Memory (PROM) devices.

The short program you loaded in turn loads the program BOOT (or MIBOOT, for magnetic tapes) from an external device into main memory.

Step 1 is sometimes called the "pre-boot."

2. BOOT (or MIBOOT) checks main memory and then loads in the operating system (or another program) from an external device.

In most cases, once you initiate the pre-boot (Step 1), the rest of the boot proceeds automatically. An exception is the case of a boot from magnetic tape, which requires several additional steps.

Cold Start

Starting up PRIMOS is referred to as a cold start. Until PRIMOS is started up, no users can use the system except the operator. When PRIMOS starts running, users must log in and enter commands to use the system. If a user was in the middle of an edit session when PRIMOS was shut down, the user is no longer in the edit session the next time PRIMOS is started up. That user must log in and restart the edit session manually. Because this is inconvenient, cold starts are usually performed as rarely as possible. They are normally performed as part of system backup operations, after system test and maintenance activities, or following a system halt or hang.

Complete information on PRIMOS system startup can be found in the chapter on System Startup for the appropriate CPU, and in Chapter 22. Information on system backup operations is found in Volume II of this book.

HALTS AND HANGS

Sometimes, the operating system may halt or hang the system. When the system halts, the red light labeled STOP on the front of your CPU will turn on. If you have a VCP, the supervisor terminal will print a message indicating that the CPU has halted.

When the system hangs, users will react in much the same way as they react when the system halts. You can tell the difference, because the STOP light is not on. In this case, you must halt the system yourself.

For both occurrences, you have two tasks:

- Record enough information on the halt or hang to allow your System Administrator, System Analyst, or Customer Service Representative to determine the cause of the problem. This will help prevent future halts.
- Get the system up and running again as quickly as possible.

In order to provide the necessary information for later analysis, you must write complete information on the halt in the logbook. In addition, you may choose to perform a tape dump. This procedure records the entire contents of main memory on tape. A Customer Service Representative may then analyze the tape to determine why PRIMOS halted or hung. However, perform a tape dump only if repeated halts occur, or if requested by your Customer Service Representative.

Information on the procedures for handling system halts and hangs is found in the chapter with that name for each CPU.

WARM STARTS

If your system halts or hangs while running PRIMOS, you will have to determine the nature of the problem and get the system up and running again as soon as possible. In many cases, a warm start is possible. When a warm start is performed following a system halt or hang, PRIMOS attempts to continue running. This is an advantage over cold start in that it takes less time, and users do not lose their edit sessions. However, a warm start is only an attempt to continue processing, and PRIMOS may fail to continue. If this happens, you will have to cold start the system.

You can tell when a warm start succeeds, because the following message appears on all user terminals and the supervisor terminals:

***** WARM START *****

If this message does not appear within 90 seconds after the system is warm-started, or if the system halts, then the warm start has failed. Further details can be found in the chapter on System Halt and Hang Handling for the appropriate CPU.

WARNING

Do not attempt a warm start on a system that is running DBMS. If you are unsure about whether your system is running DBMS, contact your System Administrator.

SHUTTING DOWN

System operation should be gracefully halted before power is turned off. For example, users should be notified that the system is being shut down long before the shutdown actually occurs, so that they may plan to complete their work in time. Once the system is shut down, it may only be brought up again via cold start. A warm start will not work. Therefore, any users in the midst of editing files may lose some of their recent typing when the system is shut down.

In addition, PRIMOS needs time to perform some last-minute housekeeping before system power is removed. In a sense, PRIMOS keeps crucial information on user's files on the top of its desk (main memory) while the system is running. When you tell PRIMOS to shut down, it first files all of that information into its file cabinets (disk storage), and does not stop operation until it has finished this. The top of the desk is wiped clean when system power is removed, but the file cabinets are able to maintain their information.

There are other considerations when initiating a system shutdown sequence. For example, if the system is to be shut down in 5 minutes, no files should be allowed to start printing since they may take longer than 5 minutes to print. If this were to happen, either the shutdown would have to be delayed to allow the files to finish printing, or the shutdown would proceed and the aborted files would be restarted when the system was started again. This would waste paper.

When PRIMOS is shut down, it halts the CPU after performing its housekeeping. When it halts the CPU, the red STOP light turns on, and the VCP prints a message on the supervisor terminal indicating that the CPU has halted.

Many installations shut down and start up the system once a day or so to perform backup and maintenance procedures. (Usually this is the operator's duty.) Procedures for shutting a system down in these cases are described in Volume II of this book. Complete information on system shutdown procedures is given in Chapter 22, Volume II of this book, and the chapter on System Shutdown for the appropriate CPU.

PART II

The Prime 9950

PART II

The Prime 9950

2

Prime 9950 Operation

INTRODUCTION

The Prime 9950 is a powerful computer system designed for large time-shared applications. A standard system consists of two cabinets plus peripheral devices. The two cabinets contain the following components:

- Five-board Central Processing Unit (CPU)
- One-board memory controller
- Main memory unit
- Input/output controllers
- Diagnostic Processor
- System status panel

The system supports a wide variety of peripheral devices such as disks, printers, and terminals.

The operator interacts with the system by using the system status panel (which is located on the front door of the cabinet) and by using a supervisor terminal (which may be video or hardcopy). The supervisor terminal is connected to the Diagnostic Processor, which in turn controls operation of the Central Processing Unit (CPU). The Diagnostic Processor is often referred to as a Virtual Control Panel (VCP) in parts of this volume and in Volume II of this book.

This chapter describes the various control functions that are available to the operator through the use of physical control switches and of commands entered at the supervisor terminal.

SYSTEM STATUS PANEL

The system status panel is located on the front door of the Prime 9950. Figure 2-1 shows the arrangement of the controls and indicators on the system status panel.

The buttons on the left-hand side of the system status panel control the main functions of the system. The lights to the right of the buttons reflect the current state of the system.

- The SYSTEM POWER button controls the power supplies to all devices in the main cabinet. Pushing this button when power is off not only turns on the power, but also automatically starts up the system. This same button is pushed after system shutdown to turn off power.

When the ON light to the right of the SYSTEM POWER button is on, the CPU has power.

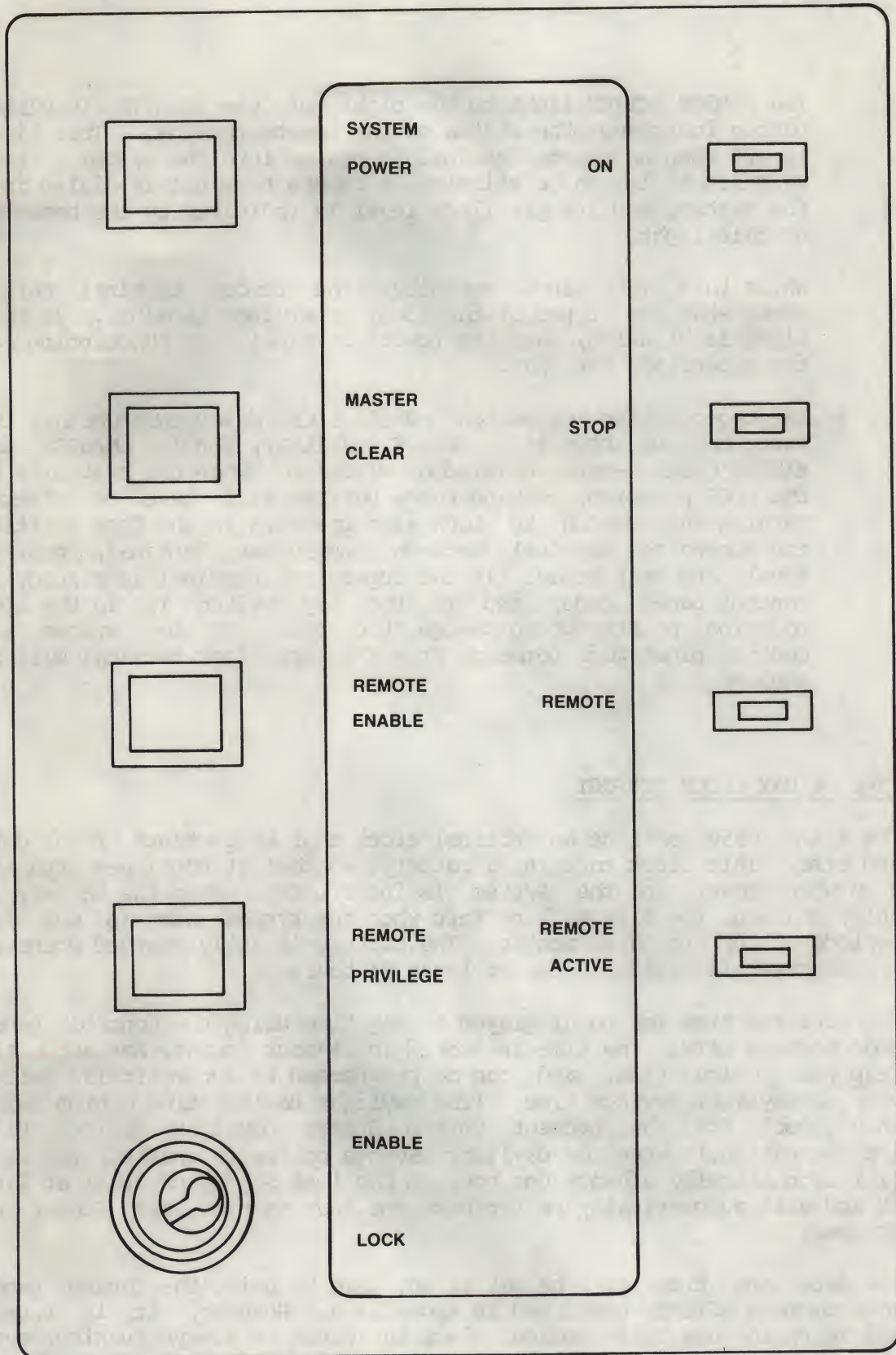
- Pushing and releasing the MASTER CLEAR button halts the CPU if it is running, then places the CPU and peripheral controllers in a properly functioning state.

When the STOP light to the right of the MASTER CLEAR button is on, the CPU has halted.

- The REMOTE ENABLE button permits or denies the use of another terminal (a remote terminal) as a supervisor terminal. Pushing the button allows such a terminal to monitor your system. This feature is used when your Customer Service Representative performs system test and maintenance activities.

When the remote supervisor terminal feature is enabled, the REMOTE light to the right of the button is on.

- The REMOTE PRIVILEGE button determines the access level of the remote supervisor terminal. Pushing the button allows the remote terminal to function as a supervisor terminal. Otherwise, the remote terminal may only monitor the supervisor terminal activity. The remote user should be granted full access only when it is certain that a Customer Service Representative is using the remote terminal.



The Prime 9950 System Status Panel
Figure 2-1

The REMOTE ACTIVE light to the right of the REMOTE PRIVILEGE button indicates the status of the remote terminal. This light is off when no remote terminal is dialed into the system. When this light is on or blinking, a remote terminal is dialed into the system, and its privilege level is indicated by the behavior of this light.

While this light glows steadily, the remote terminal merely shows what is typed at the local supervisor terminal. If this light is blinking, then the remote terminal is functioning as the supervisor terminal.

- The two-position key switch (ENABLE LOCK) determines whether the three buttons above it — REMOTE PRIVILEGE, REMOTE ENABLE, and MASTER CLEAR -- are enabled or disabled. When the switch is in the LOCK position, pushing these buttons will have no effect. Turning the switch to LOCK also prevents anyone from shifting the supervisor terminal between supervisor terminal, control panel, and user modes. If the supervisor terminal is already in control panel mode, and if the key switch is in the LOCK position, no attempt to change the state of the system via control panel mode commands from the supervisor terminal will be honored.

TIME OF DAY CLOCK SUPPORT

The Prime 9950 contains an internal clock that keeps track of the date and time. This clock contains a battery, so that it continues running even when power to the system is interrupted. When the battery is fully charged, the time will be kept when the system power is out for periods of up to three months. The battery is fully charged whenever system power is available for at least 24 hours.

The date and time may be displayed at any time using the control panel mode command DATE. The time is stored in 24-hour format, has automatic leap year calculation, and can be programmed to automatically switch over to daylight savings time. (The daylight savings time option will only work for the present United States daylight savings time implementation.) When the daylight savings option is enabled, the time will automatically advance one hour on the last Sunday of April at 2:00 AM and will automatically be set back one hour on the last Sunday of October.

The date and time may be set at any time by using the control panel mode command SETIME, described in Appendix A. However, it is rarely necessary to use this command, since the clock is always running, even when the system power is turned off.

THE SUPERVISOR TERMINAL

The supervisor terminal for the Prime 9950 system is the main link between you and the system's many programs and devices. You will use it for giving instructions to various parts of the system and for receiving and recording information from the system.

The supervisor terminal is not directly connected to the CPU. Instead, it is connected to the Diagnostic Processor. The Diagnostic Processor is a one-board microcomputer that allows the supervisor terminal to function as a supervisor terminal, a user terminal, or a control panel. These three operating modes are discussed in more detail below.

Using Supervisor Terminal Modes

The supervisor terminal for the Prime 9950 can be used in three different operating modes:

- Supervisor Terminal mode (ST)
- Control Panel mode (CP)
- User Terminal mode (USER)

This section describes the functions of each mode as well as the methods for changing from one mode to another.

Supervisor Terminal Mode: When you start up the Prime 9950, the supervisor terminal is automatically set to ST mode and logged in as SYSTEM (user 1). In ST mode, you can use the terminal for entering any of the special PRIMOS operator commands required for system monitoring and maintenance, as well as for all regular PRIMOS commands. Also, the terminal will display messages informing you of changes in the system's status, such as when users log in or log out.

Supervisor terminal mode is only available when PRIMOS or PRIMOS II is being started up (booted) or is running. If neither PRIMOS or PRIMOS II is running, the only available mode for the supervisor terminal is CP (Control Panel) mode.

Control Panel Mode: By setting the supervisor terminal to CP mode, you can use it for entering special control panel commands. (See Appendix A for a complete list.) Some of these commands perform functions similar to those performed by the system status panel controls, such as booting and master clearing. Others are used for technical procedures usually performed by a Customer Service Representative.

You may enter CP mode from either ST or USER mode, by pressing the ESCAPE key twice. A CP> prompt will appear, indicating that the terminal will accept only control panel commands. No login is required.

The supervisor terminal will automatically be set to CP mode and the CP> prompt will be displayed whenever the system halts, whether the halt is due to an error condition or during the normal course of system shutdown. (See Chapters 4 and 5 for instructions on using the control panel commands in these situations).

You will probably use CP mode most frequently when performing system backups. There are two control panel commands that allow you to start up the two available operating systems, PRIMOS and PRIMOS II. These commands are:

BOOTP	to start up PRIMOS
BOOTD	to start up PRIMOS II

Either of these commands will automatically place the supervisor terminal in ST mode and will start up the operating system.

User Mode: With the supervisor terminal set to USER mode, informative messages to the operator are inhibited. Thus, the terminal may be used for working with files without the possibility of disruptions. Also, in USER mode the terminal does not have access to the special PRIMOS operator commands. USER mode is not often used on the Prime 9950, so that the supervisor terminal may remain in ST mode, providing an accurate record of informative messages. Instead, many systems place a user terminal close to the supervisor terminal. This user terminal can be used to perform activities not requiring the use of the supervisor terminal.

Upon first entering USER mode, you must log in by typing the LOGIN command and your user id. After once logging in, you may switch to another mode, then reenter USER mode without logging in again.

USER mode is available only when PRIMOS is running and users are allowed to log in.

Note

On some systems, USER mode will not be available. This happens when no connection has been made between the CPU and the USER mode connector on the Diagnostic Processor.

If this is the case, you will receive no response when trying to log in while in USER mode. Press the ESCAPE key twice to return to CP mode.

Changing Terminal Modes

If the key switch is in the unlocked (ENABLE) position, you may change back and forth between modes at will. The following two steps are required for shifting between ST and USER modes.

1. Press the ESCAPE key twice. The CP> prompt will appear. For example:

```
OK, <ESCAPE><ESCAPE>
CP>
```

You have now placed the supervisor terminal in CP (Control Panel) mode.

2. Type the command for the mode you want to use. For example:

```
CP> MO USER (for User Terminal mode)
```

```
CP> MO ST (for System Terminal mode)
```

An Example: Suppose that after starting up the system you decide to switch from ST to USER mode for file work. If you then need to send a message to all other users on the system, you can go back to ST mode, send the message, return to USER mode, and continue your work exactly where you left off. The following steps show how this would be done:

1. Change from ST to USER mode the first time by pressing the ESCAPE key twice:

```
OK, <ESCAPE><ESCAPE>
```

This will set the terminal to CP mode. Next, type:

```
CP> MO USER
LOGIN user-id
```

In this example you proceed with file work until you need to send a message to all users.

2. Change from USER mode back to ST mode by typing:

```
OK, <ESCAPE><ESCAPE>
CP> MO ST
```

In this example, you would send the message, then return to your file work.

3. Return to USER mode from ST mode by typing:

```
OK, <ESCAPE><ESCAPE>
CP> MO USER
```


Note

If you need to leave the supervisor terminal unattended, but want to protect against unauthorized use of operator commands, you may set the terminal to USER mode, turn the front panel key switch to LOCK position, and remove the key. This will prevent anyone else from shifting the terminal to CP or ST modes.

Controlling Supervisor Terminal Output

If the supervisor terminal is in ST mode, it will normally display (or print) informative messages about various system-related events as these events occur. Such events include logins, logouts, disk errors, and others. In USER and CP modes, however, these messages are not displayed. Instead, the messages are stored in a buffer and then displayed when you re-enter ST mode.

You will rarely need to change the way the system handles status messages. If you should need this, use the control panel commands SYSOUT INT, SYSOUT IGN, and SYSOUT BUFF to control supervisor terminal output. These commands are fully described in Appendix A.

Recording Supervisor Terminal Activity

If your supervisor terminal is a hardcopy terminal, you will automatically have a printed record of all messages sent to the supervisor terminal and all commands typed at the terminal. However, if your supervisor terminal is a video display unit (VDU), you will have no permanent record of this data unless you take special measures to save it in a command output file. The procedure for doing this is described in Chapter 22.

3

Prime 9950 Startup

INTRODUCTION

The Prime 9950 features an automated startup procedure at system power-up. Usually, the operator will only have to turn on the equipment and enter one command for the system to become ready for user login. The Diagnostic Processor will perform all other startup procedures, including automatic booting of PRIMOS.

Sometimes, the operator may want to start up PRIMOS II, rather than starting PRIMOS. To do this, the operator interrupts the startup procedures performed by the Diagnostic Processor, and boots PRIMOS II.

The first section of this chapter describes how to use the automated startup feature to boot PRIMOS or PRIMOS II. The second section describes the actions you should take following a successful system boot. For a detailed discussion of system startup, see Chapter 22.

AUTOMATED STARTUP

This section discusses three operations that require the operator's attention during the 9950's automated startup procedure, if PRIMOS is to be started up:

- Turning on power to equipment
- Monitoring the progress of the automated startup sequence
- Enabling user login

If PRIMOS II is to be started up, the three operations are:

- Turning on power to equipment
- Interrupting the automated startup sequence to prevent PRIMOS from being started
- Issuing a Diagnostic Processor command to start up PRIMOS II

Turning on Power to Equipment

Turn on power to the equipment in this order:

1. Turn on the power to the supervisor terminal.
2. Be sure the front panel key switch on the system status panel is set to ENABLE.
3. Turn on the SYSTEM POWER switch on the system status panel.
4. Turn on the power to the disk drives, and wait for the disk drives to become ready. (When the disk drives are ready, the READY lights remain steadily lit.)
5. If needed for immediate use, turn on other peripheral devices such as printers and tape drives.

Note

A system may be connected to more than one tape drive or line printer through controllers. In order for any tape drive or line printer on a controller to function, all tape drives or line printers on that controller must be turned on.

Monitoring the Automated Startup

When you turn on the SYSTEM POWER switch, an automated startup procedure begins which includes these four main operations:

- Power is supplied to all devices in the cabinet.
- Diagnostic Processor circuits are tested for correct operation.
- CPU and controller circuits are tested for correct operation.
- PRIMOS is automatically loaded (bootstrapped) from the main disk.

This procedure is controlled by the Diagnostic Processor, and it takes about 5 minutes to complete. During the procedure, the supervisor terminal will display messages that tell you what the system is doing. The actual terminal display depends on the system's configuration, but will include a series of messages something like this:

```
DPM000: Diagnostic Processor beginning self verification.
DPM001: Diagnostic Processor self verification completed.
        08 Apr 83 10:02:30 Wednesday
```

```
Microdiagnostics and Control Program
Copyright (c) Prime Computer Inc., 1983
All Rights Reserved
```

```
DPM002: Beginning Central Processor system verification, please wait.
DPM003: Diagnostic " SYSVERIFY1 " successfully completed.
DPM003: Diagnostic " SYSVERIFY2 " successfully completed.
DPM004: Central Processor system verified.
        08 Apr 83 10:02:59 Wednesday
DPM005: Beginning Central Processor system initialization, please wait.
DPM006: Central Processor system initialization completed.
        08 Apr 83 10:03:54 Wednesday
DPM007: System booting, please wait.
```

```
PRIMOS II REV 19.1 11/22/82 (AT 170000)
STARTING UP DISK 001060
```

```
PRIMOS
A PRIRUN
/* C_PRMO, CMDNCO, WAC, 04/01/83
/* C_PRMO FILE FOR BRINGING UP PRIMOS
/*
CONFIG -DATA CONFIG
PRIMOS 19.2
```

```
8192K BYTES MEMORY IN USE
```


Starting up revision 19 partition "IM".
Beginning Network Initialization.

NETMAN (user 122) logged in Wednesday, 06 Apr 83 10:04:57.
NETWORK INITIALIZED.

System clock has been initialized.

OK, ADDISK 1060 21060 41060 61060

Starting up revision 19 partition "IM".

Starting up revision 19 partition "ZAPHOD".

·
·
·

OK, /* ENTER THE MAXUSR COMMAND TO ENABLE LOGIN

OK, COMINPUT -END

OK,

When the automated startup procedure has finished, the PRIMOS prompt (OK,) appears at the supervisor terminal, along with a reminder of the additional step the operator must take to allow other users to log in.

Note

If the Diagnostic Processor clock is not valid, PRIMOS will not use the date and time provided by the clock. Instead, you will have to enter the SETIME command before continuing. See Appendix A for information on the SETIME command.

Enabling User Login

To allow users to log in, you enter the MAXUSR command at the supervisor terminal. Use the following command format:

MAXUSR [n]

Normally, you would omit n, allowing as many users to log in as is permitted by the system configuration. If you specify n, you set the maximum number of users allowed to be logged in at one time.

As soon as you enter the MAXUSR command, the following message will be displayed at all user terminals:

Login please.

OK,

After this, as long as the number of users does not exceed the current setting of MAXUSR, users will be able to log in and use the system.

Note

When MAXUSR is first entered after a system coldstart, two actions occur. First, the maximum number of allowable users is set to n (if specified); second, user login is enabled and the login message is sent to user terminals.

19.2

When MAXUSR is entered at any other time, only the first action occurs.

Interrupting Startup Before PRIMOS Is Running

When system power is turned on, the automated startup procedure starts up PRIMOS as described above. If you want to run the PRIMOS II operating system rather than PRIMOS, interrupt the startup procedure before PRIMOS is started.

Interrupting PRIMOS Startup: First, allow the automated startup procedure to reach the following point:

DPM000: Diagnostic Processor beginning self verification.

DPM001: Diagnostic Processor self verification completed.

08 Apr 83 10:02:30 Wednesday

When it reaches this point, type a CONTROL-P at the supervisor terminal. This will interrupt the autoboot sequence, and produce the "CP>" prompt.

The CONTROL-P key may be pressed at any time while the system is printing the following:

Microdiagnostics and Control Program
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All Rights Reserved

DPM002: Beginning Central Processor system verification, please wait.

DPM003: Diagnostic "SYSVERIFY1" successfully completed.

DPM003: Diagnostic "SYSVERIFY2" successfully completed.

DPM004: Central Processor system verified.

08 Apr 83 10:02:59 Wednesday

DPM005: Beginning Central Processor system initialization, please wait.

DPM006: Central Processor system initialization completed.

08 Apr 83 10:03:54 Wednesday

However, the sooner you type CONTROL-P after the Diagnostic Processor self verification completes, the better your chances of interrupting the startup procedure before PRIMOS is booted. Typing CONTROL-P will not work once the automated startup procedure reaches the point where it prints the following message:

DPM007: System booting, please wait.

Once this point is reached, you must press the ESCAPE key twice, and enter the STOP command when the "CP>" prompt is issued. However, there is usually plenty of time during which CONTROL-P will work, so this method is rarely necessary.

Starting Up PRIMOS II: When you type CONTROL-P, the Diagnostic Processor will respond with the "CP>" prompt. Enter the following command:

BOOTD

The system will respond with messages that appear as follows:

DPM002: Beginning Central Processor system verification, please wait.
 DPM003: Diagnostic "SYSVERIFY1" successfully completed.
 DPM003: Diagnostic "SYSVERIFY2" successfully completed.
 DPM004: Central Processor system verified.
 08 Apr 83 10:02:59 Wednesday
 DPM005: Beginning Central Processor system initialization, please wait.
 DPM006: Central Processor system initialization completed.
 08 Apr 83 10:03:54 Wednesday
 DPM007: System booting, please wait.

PRIMOS II REV 19.1 11/22/82 (AT 170000)
 STARTING UP DISK 001060

OK:

You are now running PRIMOS II.

If Problems Occur During Automated Startup

If the automated startup procedure fails to work as expected, you should inform the System Administrator. Enter a complete description of the problem in the system logbook. (Include any messages that might be displayed or printed at the supervisor terminal.) Messages that indicate potentially serious problems with the system are:

ERR0mm: Diagnostic Processor memory error.
 ERR020: Diagnostic Processor Serial I/O error.
 ERR05c: Diagnostic Processor error on CTC Channel c.
 ERR054: Diagnostic Processor CTC Interrupt error.
 ERR060: Diagnostic Processor Serial I/O error on CPU Port.
 ERR061: Diagnostic Processor Serial I/O error on Local Port.
 ERR062: Diagnostic Processor Serial I/O error on System Port.
 ERR063: Diagnostic Processor Serial I/O error on Remote Port.
 ERR071: Diagnostic Processor detects high cabinet temperature.
 ERR072: Diagnostic Processor cabinet temperature sensor
 inoperative.
 ERR073: Diagnostic Processor board temperature sensor inoperative.
 ERR074: Diagnostic Processor air flow sensor inoperative.

ERR075: Diagnostic Processor detects power supply failure.
 ERR100: Failure detected in Microdiagnostic "<filename>", Test
 <nnnn>
 ERR117: Decode Net Verification error.
 ERR131: Verification error on file "<filename>"
 ERR202: Unable to determine Central Processor System type.
 ERR300: CPU not responding during loading of Microcode.
 ERR301: CPU not responding.
 ERR304: Diagnostic Processor CPU Verification error.
 ERR306: Attempt to resynchronize failed.
 ERR307: CPU Interface verification error.
 ERR308: Verification error on Decode Net file "<filename>"
 ERR309: CPU Pipeline Synchronization failure.
 ERR311: Diagnostic Processor CPU communication error.
 ERR375: Verification error on file "<filename>", Word <nnnn>

Such a message usually indicates a Diagnostic Processor or CPU circuit failure that must be corrected by a Customer Service Representative. See Appendix B for a complete list of Diagnostic Processor error messages.

If no messages appear at the supervisor terminal, the startup sequence has stopped for a reason the Diagnostic Processor can't diagnose. The system is then in a "hung" condition. In this case you may be able to solve this the condition by pushing the MASTER CLEAR button. If this fails to clear the condition, try turning the power off, then on again. If the system still does not start, or if the problem recurs, contact your Customer Service Representative.

AFTER SYSTEM STARTUP

After the system is up and running, you should turn on any other devices. Such devices may include the following:

- Magnetic tape drives
- Dataphone sets on automatic answer
- Other peripheral devices such as line printers

In addition, you should start up any subsystems that were not started during normal system startup. For more information, see Chapter 22.

THE FIRST PART OF THE BOOK IS A HISTORY OF THE

REIGN OF THE EMPEROR SHUNSU, WHO REIGNED FROM 1123 TO 1135.

THE SECOND PART OF THE BOOK IS A HISTORY OF THE

REIGN OF THE EMPEROR SHUNSU, WHO REIGNED FROM 1123 TO 1135.

THE THIRD PART OF THE BOOK IS A HISTORY OF THE

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REIGN OF THE EMPEROR SHUNSU, WHO REIGNED FROM 1123 TO 1135.

THE SIXTH PART OF THE BOOK IS A HISTORY OF THE

REIGN OF THE EMPEROR SHUNSU, WHO REIGNED FROM 1123 TO 1135.

4

Prime 9950 Halts and Hangs

INTRODUCTION

The Prime 9950 is designed to give reliable, efficient service under a wide range of conditions. However, after certain hardware or software failures the system may unexpectedly stop functioning ("halt" or "hang"). If this happens, the operator has the dual responsibilities of restoring service to users and of recording information on the cause of the failure.

This chapter defines recovery procedures for the operator to follow in case of a system halt or hang. The first section describes how to recognize different types of halts and hangs and how to recover from halts or hangs that occur under PRIMOS II or while booting. The second and third sections describe how to handle PRIMOS hangs and halts.

Caution

Never use the MASTER CLEAR button or the SYSCLR and VIRY commands before you have recorded the halt location in the system logbook and have determined all the recovery actions you will be performing. Some recovery actions will be ineffective unless they are taken before using MASTER CLEAR, SYSCLR, or VIRY.

RECOGNIZING HALTS AND HANGS

If the Prime 9950 suddenly stops working, your first task is to determine whether the problem is a halt or a hang and then which operating system was active when the problem occurred. This information will help you choose the proper recovery procedures.

Halts Versus Hangs

These are indications that a halt has occurred:

- The STOP light on the front panel is on, indicating that the CPU is not running.
- A halt message is displayed at the supervisor terminal. For example:

```
DPM400: CPU halted at 000004/000306: 003776
DPM701: Machine check.
        07 Apr 83 23:42:17 Wednesday
```

- The supervisor terminal is placed in Control Panel mode, as indicated by the CP> prompt.

These are indications that a hang has occurred:

- The STOP light on the front panel is off, but the CPU is unresponsive to commands from user terminals or from the supervisor terminal.
- No halt message is displayed at the supervisor terminal.
- The supervisor terminal may or may not function in Control Panel mode.

Operating System Dependencies

The actions taken at this point depend on whether PRIMOS or PRIMOS II was running at the time of the halt or hang.

When PRIMOS is being started up, it is considered running as soon as the following message appears at the supervisor terminal:

```
PRIMOS 19.2
```

When PRIMOS II is being started up, it is considered running as soon as this message is printed at the supervisor terminal:

```
PRIMOS II REV 19.1 11/22/82 (AT 170000)
```


If PRIMOS Is in Control: Perform the procedures in Handling Hangs Under PRIMOS or Handling Halts Under PRIMOS, below.

If PRIMOS II Is in Control: If the CPU is hung, halt the system by pressing the MASTER CLEAR button on the system status panel.

If the CPU is already halted, or after you halt it, enter the Diagnostic Processor command DOS to attempt to restart PRIMOS II. PRIMOS II should respond with the prompt OK:. If it does not, try the Diagnostic Processor command BOOTD. This starts up a fresh copy of PRIMOS II. If PRIMOS II does not produce its introductory message within about 20 seconds, make certain that the system disks are working and ready. If there are still problems, contact your System Administrator.

If Neither Operating System Is in Control: If the halt or hang occurred while PRIMOS or PRIMOS II was being booted, check all system disks to make sure they are operational. Then retry the Diagnostic Processor command sequence to start up PRIMOS or PRIMOS II. If problems persist, contact your System Administrator.

Note

The remainder of this chapter assumes that PRIMOS was in control at the time of the halt or hang.

HANDLING HANGS UNDER PRIMOS

Follow these steps in handling hangs under PRIMOS:

1. Note in the system logbook that a hang occurred and give the time and date when it happened.
2. Try to halt the CPU by setting the supervisor terminal to Control Panel mode and giving the STOP command. If this works, the front panel STOP light will go on and a halt message will appear at the supervisor terminal. For example:

<ESCAPE><ESCAPE>

CP> STOP

DPM400: CPU halted at 000006/015555: 140734

10 Apr 83 09:43:27 Sunday

CP>

If entering the STOP command does not work, press the MASTER CLEAR button on the system status panel.

If pressing the MASTER CLEAR button does not stop the system, turn the system power off and then on again. The system will automatically start PRIMOS, as described in Chapter 3. (If the system has been powered off and then on again, do not perform steps 3 and 4.)

3. If requested by Customer Service, or if repeated hangs have occurred, perform a memory to tape dump. For instructions, see Table 4-2, code D.
4. Restart the system by entering the Diagnostic Processor command BOOTP.
5. Record all hang-handling actions you take and their results in the system logbook.

HANDLING HALTS UNDER PRIMOS

Follow these steps in handling halts under PRIMOS:

1. Record the complete halt message in your system logbook, along with the time and date of the halt.
2. Examine the halt message. A sample halt message is:

DPM400: CPU halted at 000004/000306: 003776
DPM701: Machine check.

The "Machine check" line indicates the nature of the halt. One of three lines may follow the "CPU halted" message, or no such line may follow.

The three possible lines that may follow all begin with "DPM70n: ". If no such line follows the "CPU halted" message, then the nature of the halt is not recognized by the Diagnostic Processor. Otherwise, the Diagnostic Processor has determined the nature of the halt. You use this information to determine your course of action.

3. Look up the nature of the halt in Table 4-1 and determine what actions codes to use for recovery.
4. Perform the appropriate recovery procedures by using the instructions in Table 4-2. Always perform action code procedures in the order indicated in Table 4-1, so that diagnostic data from the memory and CPU will be obtained before the state of the system is changed by a restart procedure.
5. Record all halt-handling actions and their results in the system logbook. This information will help a System Analyst or Customer Service Representative determine the cause of the halt.

If you cannot get the system running again by following the procedures in this chapter, or if halts or hangs recur, consult your Customer Service Representative.

Table 4-1
Action Codes for Halts

Halt Message	Action Codes
DPM701: Machine check	R, D, then W
DPM702: Missing Memory Module	D, then C
DPM703: Memory Parity (ECCU)	X
None of the above	D, then W

Table 4-2
Recovery Procedures

Code	Action
C	<p><u>Cold Start</u></p> <p>Enter the Diagnostic Processor command:</p> <p>CP> <u>BOOTP</u></p>
D	<p><u>Crash Magnetic Tape Dump</u></p> <p>If requested by your Customer Service Representative, or if the system repeatedly halts or hangs, perform the following steps:</p> <ol style="list-style-type: none"> 1. Mount an available tape on a drive unit (unit number 0 to 3). Make sure the write ring is in place and the drive unit is set on line. 2. Type: <p>CP> <u>TAPEDUMP unit</u></p> <p><u>unit</u> is the tape drive unit number on which you mounted the tape.</p> 3. The tape will write necessary information and then rewind. This procedure is called a tape dump. Label the tape with the date and time of the halt and, if needed, the machine identification. If the tape does not rewind, repeat the procedure. Record the dump in the logbook, and give the tape to the person responsible for examining unusual halts.

Table 4-2 (continued)
Recovery Procedures

Code	Action
R	<p><u>Record Register Settings</u></p> <p>The Diagnostic Processor will have automatically output the contents of informational registers. Enter the output in the logbook. The output will have the following appearance:</p> <pre> DSWSTAT 150000/000035: 100014 000000 DSWPARITY 150000/000027: 000000 000000 DSWRMA 150000/000034: 000014 001414 DSWPB 150000/000036: 000014 001411 </pre>
W	<p><u>Warm Start</u></p> <p>Attempt to warm start the machine. Enter the command:</p> <pre> CP> WARMSTART DPM006: Central Processor system initialization completed. 10 Apr 83 09:46:33 Sunday SYSTEM WARM STARTING, PLEASE WAIT ***** WARM START ***** </pre> <p><u>Note</u></p> <p>A warm start may run for 90 seconds or more before the WARM START message appears at the user terminals. It will be slightly longer before a message appears at the supervisor terminal. Do not assume a warm start has failed without waiting 90 seconds and checking the user terminals for the WARM START message.</p> <p>If this fails, either no message will be displayed or the system will halt. In this case, perform a cold start (action code C, above).</p>

Table 4-2 (continued)
Recovery Procedures

Code	Action
X	<p><u>Uncorrected Memory Parity Error</u></p> <ol style="list-style-type: none"> Type the following and record the results in the logbook: <div style="margin-left: 40px;"> CP> <u>D X</u> (value) CP> <u>D A</u> (value) CP> <u>D B</u> (value) </div> Check the value that was printed when you typed D X. <p style="margin-left: 40px;">If the value for X is 1, perform a cold start by following action code C.</p> <p style="margin-left: 40px;">If the value for X is not 1, take two steps. First, type RUN:</p> <div style="margin-left: 80px;"> CP> <u>RUN</u> DPM400: CPU halted at 000004/000320: 003776 07 Apr 83 23:42:17 Wednesday CP> </div> <p style="margin-left: 40px;">Then, when the CP> prompt reappears, perform a warm start by following action code W.</p>

5

Prime 9950 Shutdown

INTRODUCTION

Shutting down the Prime 9950 involves simply shutting down the operating system (PRIMOS or PRIMOS II) and then powering down the system in the proper order.

In addition, the Prime 9950 has the ability to shut itself down if it determines that the current operating conditions may cause damage to sensitive components or if it detects a failure in its cooling system.

This chapter discusses the following procedures:

- Shutting down the operating system
- Removing system power
- Emergency system shutdown due to sensor check (initiated automatically by the Diagnostic Processor)

SHUTTING DOWN THE OPERATING SYSTEM

The procedure for shutting down the operating system depends upon whether PRIMOS or PRIMOS II is running.

Shutting Down PRIMOS

Before shutting down PRIMOS, you should warn the user community of the impending shutdown. For information on how to do this, see Chapter 22.

To shut down PRIMOS, type the following:

```
OK, SHUTDN ALL
REALLY? YES
WAIT,
PRIMOS NOT IN OPERATION
```

```
DPM400: CPU halted at 000006/003525: 003776
      12 Apr 83 12:52:17 Tuesday
```

```
CP>
```

When the "REALLY?" prompt is given, any answer except "YES" aborts the shutdown. If you answer "YES", system power should then be removed, as described in Removing System Power.

Shutting Down PRIMOS II

To shut down PRIMOS II, enter the following command:

```
OK: SHUTDN
OK:
```

Unlike PRIMOS, PRIMOS II will not halt the CPU as a result of this command. However, it is in effect shut down. If you wish to power down the system, do so as described below. If you wish to stop the CPU without shutting off the system power, press the MASTER CLEAR button on the system status panel.

REMOVING SYSTEM POWER

Shut down equipment in the reverse order of system startup:

- Turn off peripheral devices.
- Turn off dataphone sets.
- Turn off all magnetic tape drives.
- Turn off disk drives; wait until all disks have stopped.
- Turn off the CPU.

EMERGENCY SHUTDOWN DUE TO SENSOR CHECK

The Prime 9950 contains three environmental sensors to monitor the operating conditions of the CPU. These sensors are strategically placed to provide early warning of possible CPU malfunction due to overly high temperatures. The sensors detect the possibility of overheating in three separate ways, so that if one method is unable to detect a potential problem, the other two sensors function as fail-safe sensors. The three sensors are as follows:

- The cabinet sensor. This sensor is tripped when the temperature inside the CPU cabinet exceeds the maximum operating level.
- The air flow sensor. This sensor is tripped when insufficient air flow is detected. Insufficient air flow will lead to CPU and main memory damage if power to the system is not removed.
- The board sensor. This sensor is tripped when the temperature on the CPU boards themselves reaches a critical level.

When any one of these three sensors is tripped, the Diagnostic Processor immediately commences an emergency shutdown procedure. The precise nature of this procedure depends on which sensor was tripped.

During the emergency shutdown process, no commands will be accepted at the supervisor terminal, whether in CP, ST, or USER mode. The supervisor terminal will output the messages sent by PRIMOS and the Diagnostic Processor during the emergency shutdown process.

All three sequences end with shutting off system power at the circuit breaker level. Under no circumstances should you attempt to restore system power until the cause of the sensor trip is known. Possible causes and actions to take are described below.

Cabinet Sensor

When the cabinet overtemperature sensor is tripped, the Diagnostic Processor begins a slow shutdown sequence. Users are logged out, PRIMOS shuts itself down in an orderly fashion, and then system power is removed at the circuit breaker level.

A ten-minute limit is imposed on this shutdown sequence. If, after ten minutes, PRIMOS has not shut itself down, the Diagnostic Processor will nevertheless remove system power.

This sensor may be tripped when the air conditioner in the computer room is failing to maintain proper operating conditions for the processor. If this is the case, system power may be restored after the air conditioner is repaired and proper operating conditions have been restored.

Airflow Sensor

When the insufficient airflow sensor is tripped, the Diagnostic Processor begins a fast shutdown sequence. Users are logged out, PRIMOS shuts itself down in an orderly fashion, and then system power is removed at the circuit breaker level.

A one-minute limit is imposed on this shutdown sequence. If, after one minute, PRIMOS has not shut itself down, the Diagnostic Processor will nevertheless remove system power.

This sensor is tripped when there is a failure in the internal cooling machinery of the system. Under no circumstances should any attempt to restore power be made until the system has been checked by a Customer Service Representative.

Board Sensor

When the board overtemperature sensor is tripped, the Diagnostic Processor immediately removes system power at the circuit breaker level. The integrity of the file system will probably be compromised, so FIX_DISK must be run when the system is brought back up later. Under no circumstances should system power be restored until a Customer Service Representative has determined the cause of the overtemperature condition and repaired the problem.

Emergency Shutdown Example

Here is an example of a shutdown due to cabinet overtemperature:

```
ERR400: Diagnostic Processor detects Cabinet overtemperature
        System shutdown in progress.
        Refer to the System Operator's Guide.
        12 Apr 83 13:47:01 Tuesday
PRIMOS SHUTTING DOWN DUE TO SENSOR CHECK.
NO COMMANDS ACCEPTED.
SHUTDOWN COMPLETE
```

```
DPM400: CPU halted at 000006/002717: 003776
        12 Apr 83 13:47:13 Tuesday
```

```
WRN400: Diagnostic Processor shutting down system power.
        Refer to the System Operator's Guide.
        12 Apr 83 13:47:13 Tuesday
```

At this point, system power is removed at the circuit breaker level.

PART III

The Prime 2250

THE

THE

6

Prime 2250 Operation

INTRODUCTION

The Prime 2250 is a compact computer system designed for office use. A standard system includes the following components, all housed in a single, desk-height cabinet:

- Two-board Central Processing Unit (CPU)
- Main memory unit
- Input/output controllers
- Diagnostic Processor
- Winchester disk
- Cartridge tape drive

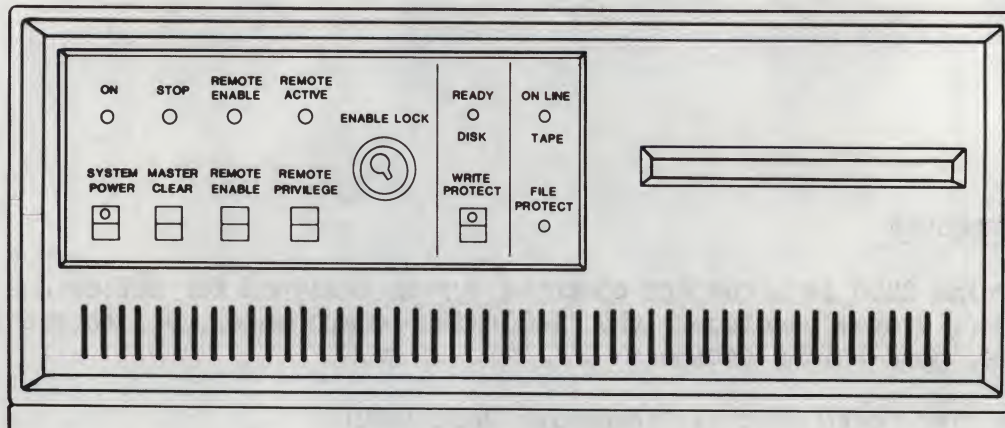
The system supports a variety of peripheral devices such as printers and terminals.

The operator interacts with the system by using a set of controls and indicators on the front of the cabinet and by using a supervisor terminal (which may be video or hardcopy). The supervisor terminal is connected to the Diagnostic Processor, which in turn controls operation of the Central Processing Unit (CPU). The Diagnostic Processor is often referred to as a Virtual Control Panel (VCP).

This chapter describes the various control functions that are available to the operator through the use of physical control switches and of commands entered at the supervisor terminal.

CONTROLS AND INDICATORS

Controls and status indicators for the 2250 system are located on the front of the main cabinet, in the topmost panel (along with the cartridge tape drive opening). Figure 6-1 shows how the front panel controls are arranged.



Prime 2250 Controls and Indicators
Figure 6-1

The buttons in the leftmost section of the panel control the main functions of the system, as indicated by the lights above the buttons.

- The SYSTEM POWER button controls the power supplies to all devices in the main cabinet. Pushing this button when power is off not only turns on the power, but also automatically starts up the system. That is, it starts the disk(s) spinning and then boots the operating system. This same button is pushed during system shutdown to turn off power.

When the ON light above the SYSTEM POWER button is on, the CPU has power.

- When the STOP light is on, the CPU has halted.

Pushing and releasing the MASTER CLEAR button places the CPU in a properly functioning state, and then starts the system.

- The REMOTE ENABLE button permits or denies the use of another terminal (a remote terminal) as a supervisor terminal. Pushing the button allows such a terminal to monitor your system. In general, this feature is used only by your Customer Service Representative.

When the remote supervisor terminal feature is enabled, the REMOTE ENABLE light above the button is on.

- The REMOTE PRIVILEGE button determines the access level of the remote supervisor terminal. Pushing the button allows a specified remote terminal to function as a supervisor terminal. Otherwise, the remote terminal may only monitor the supervisor terminal activity. In general, this feature is used only by your Customer Service Representative.

The REMOTE ACTIVE light above REMOTE PRIVILEGE button indicates the status of the remote terminal. This light is off when no remote terminal is dialed into the system. When this light is on or blinking, a remote terminal is dialed into the system, and its privilege level is indicated by the behavior of this light.

While this light glows steadily, the remote terminal merely shows what is typed at the local supervisor terminal. If this light is blinking, then the remote terminal is functioning as the supervisor terminal.

- The two-position key switch (ENABLE LOCK) enables or disables the three buttons directly to its left (REMOTE PRIVILEGE, REMOTE ENABLE, and MASTER CLEAR). When the switch is in the LOCK position, pushing any of these buttons will have no effect. Turning the switch to LOCK also prevents anyone from shifting the supervisor terminal between supervisor terminal, control panel, and user terminal modes. If the supervisor terminal is already in Control Panel mode, and if the key switch is in the LOCK position, no attempt to change the state of the system via Control Panel mode commands from the supervisor terminal will be honored.

The indicator lights and button to the right of the LOCK are connected to the system's main disk drive and cartridge tape drive.

- The READY light goes on as soon as the disk drive has reached its proper speed, and indicates that the disk is ready for use. The light flickers when some part of the disk is being accessed by a user.
- The WRITE PROTECT button controls disk access for the entire disk. Pushing the button prevents users from adding data to the disk or changing data. An indicator on the button itself lights up when the disk is protected.

WARNING

If your system has only one disk, the WRITE PROTECT button must never be pushed.

- The ON LINE light is on when a tape cartridge is properly inserted in the tape drive.
- The FILE PROTECT light is on when a cartridge mounted in the drive has been write-protected. The light is also on when no tape is mounted in the drive.

Note

If your system has a second disk and/or tape drive mounted in the center module of the main cabinet, the appropriate controls will be located on a separate front panel. These controls function in the same way as those on the main panel.

THE SUPERVISOR TERMINAL

The supervisor terminal for your 2250 system is the main link between you and the system's many programs and devices. You will use it for giving instructions to various parts of the system, and for receiving and recording information from the system.

Using Supervisor Terminal Modes

The supervisor terminal for the 2250 system can be used in three different operating modes:

- Supervisor Terminal mode (ST)
- Control Panel mode (CP)
- User Terminal mode (USER)

This section describes the functions of each mode as well as the methods for changing from one mode to another.

Supervisor Terminal Mode: When you start up the 2250, the supervisor terminal is automatically set to ST mode, and logged in as SYSTEM (user 1). In ST mode, you can use the terminal for entering any of the special PRIMOS operator commands required for system monitoring and maintenance, as well as for all regular PRIMOS commands. Also, the terminal will display messages informing you of changes in the system's status, such as when users log in or log out.

Control Panel Mode: By setting the supervisor terminal to CP mode, you can use it for entering special Control Panel commands (see Appendix A for a complete list). Some of these commands perform similar functions to those performed by the front panel switches (booting, stopping, master clearing, and so on). Others are used for technical procedures usually performed by a Customer Service Representative.

You may enter CP mode from either ST or USER modes, by pressing the ESCAPE key twice. A CP> prompt will appear, indicating that the terminal will accept only Control Panel commands. No login is required.

The supervisor terminal will automatically be set to CP mode and the CP> prompt will be displayed, whenever the system halts, whether the halt is due to an error condition, or during the normal course of system shutdown. (See Chapters 8 and 9 for instructions on using Control Panel commands in these situations.)

You will probably use CP mode most frequently for entering the two Control Panel commands that allow you to switch between ST and USER modes. They are:

MO USER	for User Terminal mode
MO ST	for Supervisor Terminal mode

User Mode: With the supervisor terminal set to USER mode, informative messages to the operator are inhibited. Thus, the terminal may be used for working with files without the possibility of disruptions. Also, in USER mode the terminal does not have access to the special PRIMOS operator commands.

Upon first entering USER mode, you must log in by typing the LOGIN command and your user id. After once logging in, you may switch to another mode, then reenter USER mode without logging in again.

Changing Terminal Modes: If the key switch is in the unlocked (ENABLE) position, you may change back and forth between modes at will. The following two steps are required for shifting between ST and USER modes; the first step alone for entering CP mode.

1. Press the ESCAPE key twice. The CP> prompt will appear. For example:

OK, <ESCAPE><ESCAPE>

CP>

2. Type the command for the mode you want to use. For example:

CP> MO USER (for User Terminal mode)

CP> MO ST (for System Terminal mode)

An Example: Suppose that after starting up the system you decide to switch from ST to USER mode for file work. If you then need to send a message to all other users on the system, you can go back to ST mode, send the message, return to USER mode, and continue your work exactly where you left off. The following steps show how this would be done:

1. Change from ST to USER mode the first time by pressing the ESCAPE key twice:

OK, <ESCAPE><ESCAPE>

This will set the terminal to CP mode. Next, type:

CP> MO USER
LOGIN user-id

In this example you proceed with file work until you need to send a message to all users.

2. Change from USER mode back to ST mode by typing:

OK, <ESCAPE><ESCAPE>
CP> MO ST

3. Return to USER mode from ST mode by typing:

OK, <ESCAPE><ESCAPE>
CP> MO USER

Note

If you need to leave the supervisor terminal unattended, and want to protect against unauthorized use of operator commands, you may set the terminal to USER mode, turn the front panel key switch to LOCK position, and remove the key. This will prevent anyone else from shifting the terminal to CP or ST modes.

Controlling Supervisor Terminal Output

If the supervisor terminal is in ST mode, it will normally display (or print) informative messages about various system-related events (such as logins and logouts) as they occur. In USER and CP modes, however, these messages are not displayed. Instead, the messages are stored in a buffer and then displayed all at once when you re-enter ST mode.

You will rarely need to change the way the system handles status messages. If you should need this, use the Control Panel commands SYSOUT INT, SYSOUT IGN, and SYSOUT BUFF to control supervisor terminal output. These commands are fully described in Appendix A.

Recording Supervisor Terminal Activity

If your supervisor terminal is a hardcopy terminal, you will automatically have a printed record of all messages sent to the supervisor terminal and all commands typed at the terminal. However, if your supervisor terminal is a video display unit (VDU), you will have no permanent record of this data unless you take special measures to save it in a command output file. The procedure for doing this is described in Chapter 22.

THE HISTORY OF THE UNITED STATES

It is a history of the United States, from the first settlement of the continent to the present day. It is a history of the people, of their struggles, of their triumphs, of their failures, of their hopes, of their dreams, of their aspirations, of their achievements, of their contributions to the world.

The history of the United States is a story of a people who have built a great nation out of a wilderness. It is a story of a people who have fought for freedom, for justice, for equality, for peace, for progress, for a better life for all.

THE HISTORY OF THE UNITED STATES

It is a history of the United States, from the first settlement of the continent to the present day. It is a history of the people, of their struggles, of their triumphs, of their failures, of their hopes, of their dreams, of their aspirations, of their achievements, of their contributions to the world.

7

Prime 2250 Startup

INTRODUCTION

The Prime 2250 features an automated startup procedure at system power-up. Usually, the system will be ready for use after the operator has only turned on the equipment and entered two commands. The VCP will perform all other startup procedures, including automatic booting of PRIMOS.

Occasionally, the operator may need more control over startup. In this case, the automated startup feature can be interrupted and alternative booting procedures performed.

The first section of this chapter describes how to use the automated startup feature. The second section describes the actions you should take following a successful system boot. The third section describes alternative booting methods. For a more detailed discussion of system startup, see Chapter 22.

AUTOMATED STARTUP

This section discusses three operations that require the operator's attention during the 2250's automated startup procedure:

- Turning on power to equipment
- Monitoring the progress of the automated startup sequence
- Enabling user login

Turning on Power to Equipment

Turn on power to the equipment in this order:

1. Turn on the power to the supervisor terminal.
2. If needed for immediate use, turn on the separate power supplies of peripheral devices such as printers and tape drives.

Note

A system may be connected to more than one tape drive or line printer through controllers. In order for any tape drive or line printer on a controller to function, all tape drives or line printers on that controller must be turned on.

3. Be sure the front panel key switch on the main cabinet is set to ENABLE.
4. Turn on the SYSTEM POWER switch on the main cabinet.

Monitoring the Automated Startup

When you turn on the SYSTEM POWER switch, an automated startup procedure begins which includes these four main operations:

- Power is supplied to all devices in the cabinet.
- VCP circuits are tested for correct operation.
- CPU and controller circuits are tested for correct operation.
- PRIMOS is automatically loaded (bootstrapped) from the main disk.

This procedure is controlled by the VCP and it takes about two minutes to complete. During the procedure, the supervisor terminal will display messages that tell you what the system is doing. The actual terminal display depends on the system's configuration, but will generally include a series of messages something like this:

```
VCP-II REV 0 VERIFIED
CPU VERIFIED
```

```
SYSTEM BOOTING, please wait
```

```
PRIMOS II REV 19.1 11/22/82 (AT 170000)
STARTING UP DISK 000460
```

```
PRIMOS
A PRIRUN
/* C_PRMO, CMDNCO, WAC, 04/01/83
/* C_PRMO FILE FOR BRINGING UP PRIMOS
/*
CONFIG -DATA CONFIG
PRIMOS 19.2
```

```
1024K BYTES MEMORY IN USE
```

```
Starting up revision 19 partition "MYSYS".
Please enter date and time.
```

```
.
.
.
```

```
OK, /* SET THE TIME AND DATE
OK, /* ENTER THE MAXUSR COMMAND TO ENABLE LOGIN
OK,
```

When the automated startup procedure has finished, the PRIMOS prompt OK, appears at the supervisor terminal, along with a reminder of the two additional steps the operator must take to allow other users to log in.

If Problems Occur During Automated Startup: If the automated startup procedure fails to work as expected, you should inform the System Administrator, and enter a complete description of the problem in the system logbook. (Include any messages that might be displayed or printed at the supervisor terminal.) Possible messages are:

```
$$$ VCP DID NOT VERIFY $$$
$$$ CPU DID NOT VERIFY $$$
```

Such a message usually indicates a VCP or CPU circuit failure that will need to be corrected by a Customer Service Representative.

If no messages appear at the supervisor terminal, this indicates that the startup sequence has stopped for a reason the VCP can't diagnose. The system is then in a "hung" condition. In this case you may be able to start the system by pushing the MASTER CLEAR button; or by turning off the power, then turning power on again. If the system still does not start, or if the problem recurs, contact your Customer Service Representative.

Enabling User Login

After PRIMOS is ready, the operator must perform the following two steps before other users will be able to log in and use the system:

1. Enter the date and time using the SETIME command (or its abbreviation, SE).
2. Enable user login using the MAXUSR command (or its abbreviation, MAX).

How to Enter the Date and Time: Use the following command format:

SETIME -mmddyy -hhmm

where mmddyy is a series of digit pairs representing the month, day, and year; and hhmm is a series of digit pairs representing the time in hours and minutes.

A space must follow the command, and hyphens must precede the date and time entries.

How to Enable User Login: Use the following command format:

MAXUSR [n]

where n is the maximum number of users allowed to be logged in at one time. If you do not specify n, the only limit on the number of users will be that of your system configuration.

As soon as you enter the MAXUSR command, the following message will be displayed at all user terminals:

Login please.
OK,

After this, as long as the number of users does not exceed the current setting of MAXUSR, users will be able to log in and use the system.

19.2

An Example: The following example shows how to prepare for user login on April 15, 1983, at 8:15 A.M.:

OK, SETIME -041583 -0815
OK, MAXUSR
OK,

Note

When MAXUSR is first entered after a system coldstart, two actions occur. First, the maximum number of allowable users is set to n (if specified); second, user login is enabled and the login message is sent to user terminals.

When MAXUSR is entered at any other time, only the first action occurs.

19.2

AFTER SYSTEM STARTUP

After the system is up and running, you should turn on any other devices, such as the following:

- Magnetic tape drives
- Dataphone sets on automatic answer
- Other peripheral devices such as line printers

In addition, you should start up any subsystems that were not started during normal system startup. For more information, see Chapter 22.

ALTERNATE STARTUP METHODS

When you use the automated startup feature, the VCP boots PRIMOS by simulating a BOOT command. This command includes a number that tells the computer what combination of devices and programs to use for the bootstrap procedure. The particular BOOT command the VCP uses includes the following set of instructions.

- Use the first controller
- Use the first disk drive
- Use the top disk partition
- Boot the PRIMOS operating system

Occasionally, you may need to boot the 2250 in a different way. For example, when installing new software, you may need to boot PRIMOS II (Prime's single user operating system). Or, if your system's main disk drive develops problems, you might want to boot from a magnetic tape.

In situations such as these, you must interrupt the VCP-controlled startup procedure and give the BOOT command yourself. Along with the command, you enter a boot number that determines how the bootstrap proceeds. For some methods of bootstrapping you also must enter the disk partition's physical device number.

The rest of this section outlines the general procedure for using alternate startup methods on the 2250 and gives directions for those operations that are common to all alternate methods.

For instructions on how to determine bootstrap numbers, see Appendix E in this volume; for information on the use of physical device numbers see Volume II of this book.

General Procedure for Using Alternate Startup Methods

1. Determine the BOOT number for the device to be booted. Also find the partition's physical device number, if required.
2. Turn on the power, as for standard startup. Then, prevent the automatic boot, as described below.
3. Boot the system using the Control Panel command BOOT.
4. If PRIMOS is started up, issue the MAXUSR command (described above) to allow users to log in.

Turning on Power and Preventing Automatic Boot

1. Turn on the power to the supervisor terminal, as described earlier in this chapter.
2. Carefully watch the messages displayed at the supervisor terminal. As soon as possible after the "System booting" message appears, press the ESCAPE key twice, setting the supervisor terminal to Control Panel mode. When the CP> prompt appears, immediately type STOP. This will interrupt the automated startup and a halt message will appear at the terminal. For example:

```
<ESCAPE><ESCAPE>
CP> STOP
```

```
HALTED AT 000505: 100040
```


The following example shows the messages and prompts displayed at the terminal, and the operator's input while interrupting the automated startup and preventing the automatic PRIMOS boot:

```
VCP-II REV 0 VERIFIED
CPU VERIFIED
```

SYSTEM BOOTING, please wait

```
<ESCAPE><ESCAPE>
CP> STOP
```

```
CPU HALTED AT 000505: 100040
CP>
```

Master Clearing and Booting the System

After stopping the automated startup, you should place the CPU in an initialized state by entering the SYSCLR command. Then you can boot the system using the command BOOT number. For example:

```
CP> SYSCLR
CPU VERIFIED
CP> BOOT 14114
```

Depending on the particular bootstrap method you have chosen (as indicated by the boot number), you may have to enter other numbers and/or commands during the booting procedure.

Note

Do not use the MASTER CLEAR button on the front panel when you wish to boot the system yourself, since MASTER CLEAR will perform an automatic PRIMOS boot, as well as initializing the CPU.

An Example: The following example shows how to interrupt the automated startup and boot PRIMOS II.

VCP-II REV 0 VERIFIED
CPU VERIFIED

SYSTEM BOOTING, please wait

<ESCAPE><ESCAPE>
CP> STOP

CPU HALTED AT 000505: 100040
CP> SYSCLR
CPU VERIFIED
CP> BOOT 10114

SYSTEM BOOTING, please wait

PRIMOS II REV 19.1 11/22/82 (AT 170000)
STARTING UP DISK 000460

OK:

8

Prime 2250 Halts and Hangs

INTRODUCTION

The Prime 2250 is designed to give reliable, efficient service under a wide range of conditions. However, after certain hardware or software failures the system may unexpectedly stop functioning ("halt" or "hang"). If this happens, the operator has the dual responsibilities of restoring service to users and of recording information on the cause of the failure.

This chapter defines recovery procedures for the operator to follow in case of a system halt or hang. The first section describes how to recognize different types of halts and hangs, and how to recover from halts or hangs that occur under PRIMOS II or while booting. The second and third sections describe how to handle PRIMOS hangs and halts.

Caution

Never use the MASTER CLEAR button, or the SYSCLR and VIRY commands before you have recorded the halt location in the system logbook and have determined all the recovery actions you will be performing. Some recovery actions will be ineffective unless they are taken before using MASTER CLEAR, SYSCLR, or VIRY.

RECOGNIZING HALTS AND HANGS

If the Prime 2250 suddenly stops working, your first task is to determine whether the problem is a halt or a hang and then which operating system was active when the problem occurred. This information will help you choose the proper recovery procedures.

Halts Versus Hangs

These are indications that a halt has occurred:

- The STOP light on the front panel is on, indicating that the CPU is not running.
- A halt message is displayed at the supervisor terminal. For example:

HALTED AT 000004/000306: 003776

- The CP> prompt is displayed at the supervisor terminal, indicating that the terminal has entered control panel mode.

These are indications that a hang has occurred:

- The STOP light on the front panel is off, but the CPU is unresponsive to commands from user terminals from or the supervisor terminal.
- No halt message is displayed at the supervisor terminal.
- The supervisor terminal may or may not function in Control Panel mode.

Operating System Dependencies

The actions you take to get the system running again depend on which operating system was in control at the time of the halt or hang.

When PRIMOS is being started up, it is considered running as soon as the following message appears at the supervisor terminal:

PRIMOS 19.2

When PRIMOS II is being started up, it is considered running as soon as this message is printed at the supervisor terminal:

PRIMOS II REV 19.1 11/22/82 (AT 170000)

If PRIMOS Is in Control: Perform the procedures in Handling Hangs Under PRIMOS or Handling Halts Under PRIMOS, below.

If PRIMOS II Is in Control: If the CPU is hung, try to halt it by entering control panel mode and typing STOP. If this does not work, press and release MASTER CLEAR and restart PRIMOS II using the same procedure you used originally.

If the CPU is already halted, or after you halt it, enter the control panel command RUN 170000 to attempt to restart PRIMOS II. PRIMOS II should respond with the prompt OK:. If it does not, try the control panel commands SYSCLR and BOOT 10114. This starts up a fresh copy of PRIMOS II. If PRIMOS II does not produce its introductory message within about 20 seconds, make certain that the system disks are working and ready. If there are still problems, contact your System Administrator.

If Neither Operating System Was in Control: If the halt or hang occurred while PRIMOS or PRIMOS II was being booted, check all system disks to make sure they are operational. Then retry the original procedure you used to start up PRIMOS or PRIMOS II. If problems persist, contact your System Administrator.

Note

The remainder of this chapter assumes that PRIMOS was in control at the time of the halt or hang.

HANDLING HANGS UNDER PRIMOS

Follow these steps in handling hangs under PRIMOS:

1. Note in the system logbook that a hang occurred and give the time and date when it happened.
2. Try to halt the CPU by setting the supervisor terminal to Control Panel mode and giving the STOP command. If this works, the front panel STOP light will go on and a halt message will appear at the supervisor terminal. For example:

```
<ESCAPE><ESCAPE>
CP> STOP
HALTED AT 000004/000306: 003776
CP>
```

If entering the STOP command does not work, press and release the MASTER CLEAR button on the front panel, or turn the system power off, wait for the disk drives to spin down, and then turn the power on again. The system will automatically start PRIMOS, as described in Chapter 7. When MASTER CLEAR is used, or when power is turned off and then on again, do not perform steps 3 and 4.

3. If requested by Customer Service, or if repeated hangs have occurred, perform a memory to tape dump. For instructions, see Table 8-2, code D.
4. Perform a cold start, as described in Table 8-2, code C.
5. Record all hang-handling actions you take and their results in the system logbook.

HANDLING HALTS UNDER PRIMOS

Follow these steps in handling halts under PRIMOS:

1. Record the complete halt message in your system logbook along with the time and date of the halt.
2. Determine the halt address. This is found in the halt message. A sample halt message is:

HALTED AT 000004/000306: 003776

The halt address in this example is 000004/000306. This is the set of numbers preceding the colon (:).

3. Look up the halt address in Table 8-1 and determine what actions codes to use for recovery.
4. Perform the appropriate recovery procedures by using the instructions in Table 8-2. Always perform action code procedures in the order indicated in Table 8-1, so that diagnostic data from the memory and CPU will be obtained before the state of the system is changed by a restart procedure.
5. Record all halt-handling actions and their results in the system logbook. This information will help a System Analyst or Customer Service Representative determine the cause of the halt.

If you cannot get the system running again by following the procedures in this chapter, or if halts or hangs recur, consult your Customer Service Representative.

Table 8-1
Action Codes for Halts

Halt Address	Action Codes
000004/000277	X
000004/000306	R, D, then W
000004/000316	D, then C
All others	D, then W

Table 8-2
Recovery Procedures

Code	Action
C	<p><u>Cold Start</u></p> <p>Enter the VCP command sequence:</p> <pre> CP> <u>SYSCLR</u> CPU <u>VERIFIED</u> CP> <u>BOOT 14114</u> </pre>
D	<p><u>Crash Magnetic Tape Dump</u></p> <p>If requested by your Customer Service Representative, or if the system repeatedly halts or hangs, perform the following steps:</p> <ol style="list-style-type: none"> 1. Mount a tape cartridge in drive unit 0. 2. Type: <pre> CP> <u>SYSCLR</u> CPU <u>VERIFIED</u> CP> <u>RUN 775</u> </pre> 3. The tape will write necessary information and then rewind. This procedure is called a tape dump. If the tape does not rewind, repeat the procedure. Label the tape with the date and time of the halt and, if needed, the machine identification. Record the dump in the logbook, and give the tape to the person responsible for examining unusual halts.

Table 8-2 (continued)
Recovery Procedures

Code	Action
R	<p><u>Record Register Settings</u></p> <p>Type the following, and record the output in the logbook:</p> <pre> CP> D DSWSTAT (value) CP> D DSWRMA (value) CP> D DSWPB (value) </pre>
W	<p><u>Warm Start</u></p> <p>Attempt to warm start the machine. Enter this command sequence:</p> <pre> CP> <u>SYSCLR</u> CPU VERIFIED CP> <u>RUN</u> HALTED AT 001001: 000010 CP> <u>RUN</u> SYSTEM WARM STARTING, PLEASE WAIT ***** WARM START ***** </pre> <p><u>Note</u></p> <p>A warm start may run for 90 seconds or more before the WARM START message appears at the user terminals. It will be slightly longer before a message appears at the supervisor terminal. Do not assume a warm start has failed without waiting 90 seconds and checking the user terminals for the WARM START message.</p> <p>If this fails, no message will be displayed, or the system will halt. In this case, perform a cold start (by action code C, above).</p>

Table 8-2 (continued)
Recovery Procedures

Code	Action
X	<u>Uncorrected Memory Parity Error</u>
	1. Type the following and record the results in the logbook:
	CP> <u>D X</u> (value)
	CP> <u>D A</u> (value)
	CP> <u>D B</u> (value)
	2. Check the value that was printed when you typed D X.
	If the value for X is 1, perform a cold start by following action code C.
	If the value for X is not 1, take two steps. First, type RUN:
	CP> <u>RUN</u>
	HALTED AT 000014/000320: 003776
	CP>
	Then, when the CP> prompt reappears, perform a warm start by following action code W.

9

Prime 2250 Shutdown

INTRODUCTION

Shutting down the Prime 2250 involves simply shutting down the operating system (PRIMOS or PRIMOS II), spinning down the disk drives, and then powering down the system in the proper order.

This chapter discusses the following procedures:

- Shutting down the operating system
- Spinning down the disk drives
- Removing system power

SHUTTING DOWN THE OPERATING SYSTEM

The procedure for shutting down the operating system depends on whether PRIMOS or PRIMOS II is running.

Shutting Down PRIMOS

Before shutting down PRIMOS, you should warn the user community of the impending shutdown. For information on how to do this, see Chapter 22.

You shut down PRIMOS as shown in the following example.

OK, SHUTDN ALL
 REALLY? YES
 WAIT,
 PRIMOS NOT IN OPERATION

HALTED AT 000006/003525: 003776
 CP>

When the CP> prompt appears, spin down the disks as described below.

When the "REALLY?" prompt is given, any answer except "YES" aborts the shutdown.

Shutting Down PRIMOS II

To shut down PRIMOS II, enter the following command:

OK: SHUTDN
 OK:

Unlike PRIMOS, PRIMOS II will not halt the CPU as a result of this command. However, it is in effect shut down. Set the supervisor terminal to Control Panel mode as follows:

<ESCAPE><ESCAPE>
 CP>

If you wish to stop the CPU without shutting off the system power, enter the STOP command.

SPINNING DOWN THE DISK DRIVES

With the supervisor terminal in Control Panel mode, type SPINDOWN. You will hear the disk drive(s) begin to slow down, and eventually stop spinning. This may take up to 60 seconds. Wait until the disk(s) have completely stopped before turning off system power.

REMOVING SYSTEM POWER

Turn off power to equipment in the following order:

- Turn off the SYSTEM POWER switch on the main cabinet.
- Turn off peripheral devices, such as printers and tape drives.
- Turn off power to the supervisor terminal.

PART IV

The Prime 50 Series

PART 12

The Prime 50 Series

10

50 Series Operation

INTRODUCTION

The Prime 50 series includes the Prime 250, 250-II, 450, 550, 550-II, 650, and 750 computers. The 50 series represents a wide range of systems, including a low-end processor (the 250-II) and a powerful, high-end processor (the 750). These systems are designed for small, medium, and large-scale time-shared applications. A standard system consists of one cabinet plus peripheral devices. The cabinet contains the following components:

- Multi-board Central Processing Unit (CPU)
- Main memory unit
- Input/output controllers
- Virtual Control Panel (VCP)
- System status panel

The system supports a wide variety of peripheral devices such as disks, printers, and terminals.

The operator interacts with the system by using the system status panel (which is located at the top of the cabinet) and by using a supervisor terminal (which may be video or hardcopy). The supervisor terminal is connected to the VCP, which in turn controls operation of the Central Processing Unit (CPU).

This chapter describes the various control functions that are available to the operator through the use of physical control switches and of commands entered at the supervisor terminal.

SYSTEM STATUS PANEL

The system status panel is located on the front door of the Prime computer. Figure 10-1 shows the arrangement of the controls and indicators on the system status panel.

The buttons on the top orange panel of the cabinet control the main functions of the system. The lights above the buttons reflect the current state of the system.

- The SYSTEM POWER button controls the power supplies to all devices in the main cabinet. Pushing this button when power is off turns on the power. This same button is pushed after system shutdown to turn off power.

When the ON light above the SYSTEM POWER button is on, the CPU has power.

- Pushing and releasing the MASTER CLEAR button halts the CPU if it is running, and then places the CPU and peripheral controllers in a properly functioning state.

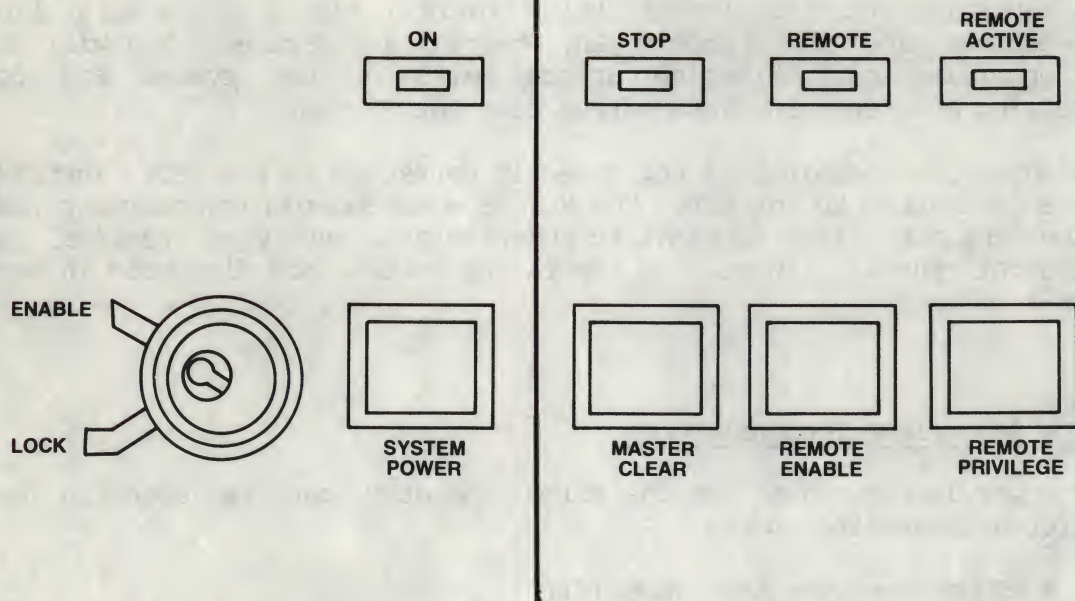
When the STOP light above the MASTER CLEAR button is on, the CPU has halted.

- The REMOTE ENABLE button permits or denies the use of another terminal (a remote terminal) as a supervisor terminal. Pushing the button allows such a terminal to monitor your system. This feature is used when your Customer Service Representative performs system test and maintenance activities.

When the remote supervisor terminal feature is enabled, the REMOTE light above the button is on.

- The REMOTE PRIVILEGE button determines the access level of the remote supervisor terminal. Pushing the button allows the remote terminal to function as a supervisor terminal. Otherwise, the remote terminal may only monitor the supervisor terminal activity. The remote user should be granted full access only when it is certain that a Customer Service Representative is using the remote terminal.

The REMOTE ACTIVE light above the REMOTE PRIVILEGE button indicates the status of the remote terminal. This light is off when no remote terminal is dialed into the system. When this light is on or blinking, a remote terminal is dialed into the system, and its privilege level is indicated by the behavior of this light.



The 50 Series Status Panel
Figure 10-1

While this light glows steadily, the remote terminal merely shows what is typed at the local supervisor terminal. If this light is blinking, then the remote terminal is functioning as the supervisor terminal.

- The two-position key switch (ENABLE LOCK) determines whether the three buttons to the far right of it — MASTER CLEAR, REMOTE ENABLE, and REMOTE PRIVILEGE — are enabled or disabled. When the switch is in the LOCK position, pushing these buttons will have no effect. Turning the switch to LOCK also prevents anyone from shifting the supervisor terminal between supervisor terminal and Control Panel modes. If the supervisor terminal is already in Control Panel mode, and if the key switch is in the LOCK position, no attempt to change the state of the system via Control Panel mode commands from the supervisor terminal will be honored.

THE SUPERVISOR TERMINAL

The supervisor terminal for the Prime computer system is the main link between you and the system's many programs and devices. You will use it for giving instructions to various parts of the system and for receiving and recording information from the system.

The supervisor terminal is not directly connected to the CPU. Instead, it is connected to the VCP. The VCP is a one-board microcomputer that allows the supervisor terminal to function as a supervisor terminal or a control panel. These two operating modes are discussed in more detail below.

Using Supervisor Terminal Modes

The supervisor terminal for the Prime computer can be used in two different operating modes:

- Supervisor Terminal mode (ST)
- Control Panel mode (CP)

This section describes the functions of each mode as well as the methods for changing from one mode to another.

Supervisor Terminal Mode: In ST mode, you can use the terminal for entering any of the special PRIMOS operator commands required for system monitoring and maintenance, as well as for all regular PRIMOS commands. Also, the terminal will display messages informing you of changes in the system's status, such as when users log in or log out.

Supervisor terminal mode is only available when PRIMOS or PRIMOS II is being started up (booted) or is running. If neither PRIMOS or PRIMOS II is running, the only available mode for the supervisor terminal is CP (Control Panel) mode.

Control Panel Mode: When you start up the Prime computer, the supervisor terminal is automatically set to CP mode. By setting the supervisor terminal to CP mode, you can use it for entering special Control Panel commands. (See Appendix A for a complete list.) Some of these commands are used to perform functions such as booting and master clearing. Others are used for technical procedures usually performed by a Customer Service Representative.

You may enter CP mode from ST mode by pressing the ESCAPE key twice. A CP> prompt will appear, indicating that the terminal will accept only control panel commands. No login is required.

The supervisor terminal will automatically be set to CP mode and the CP> prompt will be displayed, whenever the system halts, whether the halt is due to an error condition or occurs during the normal course of system shutdown. (See Chapters 12 and 13 for instructions on using the Control Panel commands in these situations).

You will probably use CP mode most frequently when performing system backups. There are three Control Panel commands that allow you to start up the two available operating systems, PRIMOS and PRIMOS II. These commands are:

SYSCLR	to initialize the CPU before startup
BOOT 14114	to start up PRIMOS
BOOT 10114	to start up PRIMOS II

The two BOOT commands will automatically place the supervisor terminal in ST mode and will start up the operating system.

Changing Terminal Modes

If the key switch is in the unlocked (ENABLE) position, you may change back and forth between modes at will. The following procedures are required for shifting between ST and CP modes:

- To switch from ST to CP mode, press the ESCAPE key twice. The CP> prompt will appear. For example:

```
OK, <ESCAPE><ESCAPE>
CP>
```

You have now placed the supervisor terminal in CP (Control Panel) mode.

- To switch from CP to ST mode, enter the MO ST command. For example:

CP> MO ST

Controlling Supervisor Terminal Output

If the supervisor terminal is in ST mode, it will normally display (or print) informative messages about various system-related events as these events occur. Such events include logins, logouts, disk errors, and others. In CP mode, however, these messages are not displayed. Instead, the messages are stored in a buffer and then displayed when you re-enter ST mode.

You will rarely need to change the way the system handles status messages. If you should need to change this, use the Control Panel commands SYSOUT INT, SYSOUT IGN, and SYSOUT BUFF to control supervisor terminal output. These commands are fully described in Appendix A.

Recording Supervisor Terminal Activity

If your supervisor terminal is a hardcopy terminal, you will automatically have a printed record of all messages sent to the supervisor terminal and all commands typed at the terminal. However, if your supervisor terminal is a video display unit (VDU), you will have no permanent record of this data unless you take special measures to save it in a command output file. The procedure for doing this is described in Chapter 22.

11

50 Series Startup

INTRODUCTION

The Prime 50 series computer systems automatically perform system initialization upon system power-up. Usually, the operator will only have to turn on the equipment and enter three commands for the system to become ready for user login.

Normally, the operator will start up PRIMOS after turning on system power. Sometimes, the operator may want to start up PRIMOS II, rather than starting PRIMOS. Occasionally, the operator may need more control over startup. The VCP allows the operator complete control over the startup procedure.

The first section of this chapter describes how to use the VCP to boot PRIMOS or PRIMOS II. The second section describes the actions you should take following a successful system boot. The third section describes alternative booting methods. For a more detailed discussion of system startup, see Chapter 22.

STANDARD SYSTEM STARTUP

This section discusses four operations that require the operator's attention during the standard startup procedure, if PRIMOS is to be started up:

- Turning on power to equipment
- Initiating the PRIMOS system startup
- Monitoring the progress of the startup sequence
- Enabling user login

If PRIMOS II is to be started up, the two operations are:

- Turning on power to equipment
- Initiating the PRIMOS II system startup

Turning on Power to Equipment

Turn on power to the equipment in this order:

1. Turn on the power to the supervisor terminal.
2. Be sure the front panel key switch on the system status panel is set to ENABLE.
3. Turn on the SYSTEM POWER switch on the system status panel.
4. Turn on the power to the disk drives and wait for the disk drives to become ready. (When the disk drives are ready, the READY lights remain steadily lit.)
5. If needed for immediate use, turn on other peripheral devices such as printers and tape drives.

Note

A system may be connected to more than one tape drive or line printer through controllers. In order for any tape drive or line printer on a controller to function, all tape drives or line printers on that controller must be turned on.

Initiating System Startup

When you turn on the SYSTEM POWER switch, the VCP automatically verifies and initializes VCP and CPU operation. This procedure includes these three main operations:

- Power is supplied to all devices in the cabinet.
- VCP circuits are tested for correct operation.
- CPU and controller circuits are tested for correct operation.

This procedure is controlled by the VCP, and it takes about four seconds to complete. During the VCP verification procedure, the REMOTE and REMOTE ACTIVE lights on the system status panel will indicate the progress of the verification procedure, as follows:

<u>REMOTE</u>	<u>REMOTE ACTIVE</u>	<u>TEST</u>
OFF	ON	Dynamic memory test
ON	OFF	Serial ports test
ON	ON	High speed buffer and mapper test

The STOP light will be on during this procedure.

After the VCP is verified, and as the CPU is being verified, the supervisor terminal will display messages that tell you the results of the verification process, as follows:

VCP.04 11-09-79

*** CPU VERIFIED ***

CP>

At this point, enter the appropriate BOOT command to start up the PRIMOS or PRIMOS II operating system, as follows:

CP> BOOT 14114 (to start up PRIMOS)

or:

CP> BOOT 10114 (to start up PRIMOS II)

This initiates the system startup process.

Monitoring the System Startup Process

As the system starts up, the supervisor terminal will display messages that tell you what the system is doing. For example:

```
PRIMOS II REV 19.1 11/22/82 (AT 170000)
STARTING UP DISK 001060
```

If you used the BOOT 10114 command to start up PRIMOS II, the OK: prompt will be issued at this point, and the startup procedure will have completed.

If you used the BOOT 14114 command to start up PRIMOS, the startup procedure will continue and more messages relating to the system startup procedure will be displayed. The actual terminal display depends on the system's configuration, but a series of messages will look something like this:

```
PRIMOS
A PRIRUN
/* C_PRMO, CMDNCO, WAC, 04/01/83
/* C_PRMO FILE FOR BRINGING UP PRIMOS
/*
CONFIG -DATA CONFIG
PRIMOS 19.2
```

4096K BYTES MEMORY IN USE

Starting up revision 19 partition "IM".
Beginning Network Initialization.

NETMAN (user 122) logged in Wednesday, 06 Apr 83 10:04:57.
NETWORK INITIALIZED.

Please enter date and time.

OK, ADDISK 1060 21060 41060 61060

Starting up revision 19 partition "IM".

Starting up revision 19 partition "ZAPHOD".

.
.
.

OK, /* ENTER SETIME COMMAND TO SET DATE AND TIME, THEN

OK, /* ENTER THE MAXUSR COMMAND TO ENABLE LOGIN

OK, COMINPUT -END

OK,

When the automated startup procedure has finished, the PRIMOS prompt (OK,) appears at the supervisor terminal, along with a reminder of the additional steps the operator must take to allow other users to log in.

Enabling User Login

After PRIMOS is ready, the operator must perform the following two steps before other users will be able to log in and use the system:

1. Enter the date and time using the SETIME command (or its abbreviation, SE).
2. Enable user login using the MAXUSR command (or its abbreviation, MAX).

Setting the Date and Time: To set the date and time, you enter the SETIME command at the supervisor terminal. Use the following command format:

```
SETIME -mmddyy -hhmm
```

Here, mmddyy is the date and hhmm is the time in 24-hour format. For example, to set the date and time to April 20, 1983, 10:38 p.m., you would enter the command:

```
SETIME -042083 -2238
```

Enabling User Login: To allow users to log in, you enter the MAXUSR command at the supervisor terminal. Use the following command format:

```
MAXUSR [n]
```

Normally, you would omit n, allowing as many users to login as is permitted by the system configuration. If you specify n, you set the maximum number of users allowed to be logged in at one time.

As soon as you enter the MAXUSR command, the following message will be displayed at all user terminals:

```
Login please.  
OK,
```

19.2

After this, as long as the number of users does not exceed the current setting of MAXUSR, users will be able to log in and use the system.

Note

When MAXUSR is first entered after a system coldstart, two actions occur. First, the maximum number of allowable users is set to n (if specified); second, user login is enabled and the login message is sent to user terminals.

When MAXUSR is entered at any other time, only the first action occurs.

If Problems Occur During Standard System Startup

If the standard system startup procedure fails to work as expected, you should inform the System Administrator. Enter a complete description of the problem in the system logbook. (Include any messages that might be displayed or printed at the supervisor terminal.) Messages that indicate potentially serious problems with the system are:

```
$$$ VCP DID NOT VERIFY $$$
$$$ CPU NOT VERIFIED $$$
```

If one of these messages appears, try issuing a VIRY command once or twice, and then try powering the system off and on again. This procedure may fix the problem. If not, such a message usually indicates a VCP or CPU circuit failure that must be corrected by a Customer Service Representative.

If no messages appear at the supervisor terminal, the startup sequence has stopped for a reason the VCP can't diagnose. The system is then in a "hung" condition. In this case you may be able to solve this condition by pushing the MASTER CLEAR button. If this does not clear the condition, try turning the power off, then on again. If the system still does not start, or if the problem recurs, contact your Customer Service Representative.

AFTER SYSTEM STARTUP

After the system is up and running, you should turn on any other devices. Such devices may include the following:

- Magnetic tape drives
- Dataphone sets on automatic answer
- Other peripheral devices such as line printers

In addition, you should start up any subsystems that were not started during normal system startup. For more information, see Chapter 22.

ALTERNATE STARTUP METHODS

The standard startup method is adequate in most cases. However, there are times when it is necessary to start up the system in another way. This is referred to as an alternate startup method.

When you use the standard startup method, the VCP command BOOT 14114 or BOOT 10114 is used to start up PRIMOS or PRIMOS II. This command includes information that tells the computer what combination of devices and programs to use for the bootstrap procedure.

The BOOT 14114 command includes the following set of instructions:

- Use the first disk drive.
- Use the first controller.
- Use the top disk partition.
- Boot the PRIMOS operating system.

Occasionally, you may need to boot the system in a different way from the standard method. For example, if your system's main disk drive develops problems, you might want to boot from a magnetic tape.

In situations such as these, you must issue a variant of the BOOT command. Along with the BOOT command, you enter a boot number that determines how the bootstrap proceeds. For some methods of bootstrapping you also must enter the disk partition's physical device number.

Information on the boot number may be found in Appendix E. Information on determining physical device numbers may be found in Volume II of this book.

General Procedure for Using Alternate Startup Methods

To start up PRIMOS or PRIMOS II in a non-standard fashion, such as from a disk on the second disk controller, use the BOOT command as follows:

1. Determine the BOOT number for the device to be booted. Also find the partition's physical device number, if required.
2. Turn on the power, as for standard startup.
3. Issue the appropriate BOOT command when you see the following message:

*** CPU VERIFIED ***

Appendix E describes how to construct the number used for the BOOT command.

4. If PRIMOS is started up, issue the SETIME and MAXUSR commands (described above) to allow users to log in.

12

50 Series Halts and Hangs

INTRODUCTION

The Prime 50 series computer systems are designed to give reliable, efficient service under a wide range of conditions. However, after certain hardware or software failures the system may unexpectedly stop functioning ("halt" or "hang"). If this happens, the operator has the dual responsibilities of restoring service to users and of recording information on the cause of the failure.

This chapter defines recovery procedures for the operator to follow in case of a system halt or hang. The first section describes how to recognize different types of halts and hangs, and how to recover from halts or hangs that occur under PRIMOS II or while booting. The second and third sections describe how to handle PRIMOS hangs and halts.

Caution

Never use the MASTER CLEAR button or the SYSCLR and VIRY commands before you have recorded the halt location in the system logbook and have determined all the recovery actions you will be performing. Some recovery actions will be ineffective unless they are taken before using MASTER CLEAR, SYSCLR, or VIRY.

RECOGNIZING HALTS AND HANGS

If the Prime computer suddenly stops working, your first task is to determine whether the problem is a halt or a hang and then which operating system was active when the problem occurred. This information will help you choose the proper recovery procedures.

Halts Versus Hangs

These are indications that a halt has occurred:

- The STOP light on the front panel is on, indicating that the CPU is not running.
- A halt message is displayed at the supervisor terminal. For example:

HALTED AT 000004/000316: 003776

- The supervisor terminal is placed in Control Panel (CP) mode, as indicated by the CP> prompt.

These are indications that a hang has occurred:

- The STOP light on the front panel is off, but the CPU is unresponsive to commands from user terminals from or the supervisor terminal.
- No halt message is displayed at the supervisor terminal.
- The supervisor terminal may or may not function in Control Panel (CP) mode.

Operating System Dependencies

The actions taken at this point depend on whether PRIMOS or PRIMOS II was running at the time of the halt or hang.

When PRIMOS is being started up, it is considered running as soon as the following message appears at the supervisor terminal:

PRIMOS 19.2

When PRIMOS II is being started up, it is considered running as soon as this message is printed at the supervisor terminal:

PRIMOS II REV 19.1 11/22/82 (AT 170000)

If PRIMOS Is in Control: Perform the procedures in Handling Hangs Under PRIMOS or Handling Halts Under PRIMOS, below.

If PRIMOS II Is in Control: If the CPU is hung, halt the system by pressing the MASTER CLEAR button on the system status panel.

If the CPU is already halted, or after you halt it, enter the following VCP commands to attempt to restart PRIMOS II:

```
SYSCLR  
RUN 170000
```

This restarts PRIMOS II. It should respond with the prompt OK:. If it does not, try the following command sequence:

```
SYSCLR  
BOOT 10114
```

This starts up a fresh copy of PRIMOS II. If PRIMOS II does not produce its introductory message within about 20 seconds, make certain that the system disks are working and ready. If there are still problems, contact your System Administrator.

If Neither Operating System Is in Control: If the halt or hang occurred while PRIMOS or PRIMOS II was being booted, check all system disks to make sure they are operational. Then retry the VCP command sequence to start up PRIMOS or PRIMOS II. If problems persist, contact your System Administrator.

Note

The remainder of this chapter assumes that PRIMOS was in control at the time of the halt or hang.

HANDLING HANGS UNDER PRIMOS

Follow these steps in handling hangs under PRIMOS:

1. Note in the system logbook that a hang occurred and give the time and date when it happened.
2. Try to halt the CPU by setting the supervisor terminal to Control Panel mode and giving the STOP command. If this works, the front panel STOP light will go on and a halt message will appear at the supervisor terminal.

For example:

<ESCAPE><ESCAPE>
CP> STOP

HALTED AT 000006/015555: 140734

CP>

If entering the STOP command does not work, press the MASTER CLEAR button on the system status panel. If this does not stop the system, turn the system power off and then on again. The system should initialize and place the supervisor terminal in CP mode. Start up PRIMOS, as described in Chapter 11, using the SYSCLR and BOOT 14114 commands. (If the system has been powered off and then on again, do not perform steps 3 and 4.)

3. If requested by Customer Service, or if repeated hangs have occurred, perform a memory to tape dump. For instructions, see Table 12-2, code D.
4. Restart the system by entering the VCP commands SYSCLR and BOOT 14114.
5. Record all hang-handling actions you take and their results in the system logbook.

HANDLING HALTS UNDER PRIMOS

Follow these steps in handling halts under PRIMOS:

1. Record the complete halt message in your system logbook, along with the time and date of the halt.
2. Examine the halt address. This is found in the halt message. A sample halt message is:

HALTED AT 000004/000306: 003776

The halt address in this example is 000004/000306. This is the set of numbers preceding the colon (:).

3. Look up the halt address in Table 12-1 and determine what actions codes to use for recovery.
4. Perform the appropriate recovery procedures by using the instructions in Table 12-2. Always perform action code procedures in the order indicated in Table 12-1, so that diagnostic data from the memory and CPU will be obtained before the state of the system is changed by a restart procedure.

5. Record all halt-handling actions and their results in the system logbook. This information will help a System Analyst or Customer Service Representative determine the cause of the halt.

If you cannot get the system running again by following the procedures in this chapter, or if halts or hangs recur, consult your Customer Service Representative.

Table 12-1
Action Codes for Halts

Halt Address	Action Codes
000004/000277	X
000004/000306	R, D, then W
000004/000316	D, then C
All others	D, then W

Table 12-2
Recovery Procedures

Code	Action
C	<p><u>Cold Start</u></p> <p>Enter the VCP command sequence:</p> <p>CP> <u>SYSCLR</u></p> <p>*** CPU VERIFIED ***</p> <p>CP> <u>BOOT 14114</u></p>
D	<p><u>Crash Magnetic Tape Dump</u></p> <p>If requested by your Customer Service Representative, or if the system repeatedly halts or hangs, perform the following steps:</p> <ol style="list-style-type: none"> 1. Mount an available tape on a drive unit (unit number 1). Make sure the write ring is in place, and the drive unit is set on line. 2. Type: <p>CP> <u>SYSCLR</u></p> <p>*** CPU VERIFIED ***</p> <p>CP> <u>RUN 776</u></p> <p>If unit number 1 is not available, you may mount the tape on unit number 0 and use the RUN 775 command instead of RUN 776 in the above command sequence.</p> 3. The tape will write necessary information and then rewind. This procedure is called a tape dump. If the tape does not rewind, repeat the procedure. Label the tape with the date and time of the halt and, if needed, the machine identification. Record the dump in the logbook, and give the tape to the person responsible for examining unusual halts.

Table 12-2 (continued)
Recovery Procedures

Code	Action
R	<p><u>Record Register Settings</u></p> <p>Type the following, and record the output in the logbook:</p> <pre> CP> D DSWSTAT (value) CP> D DSWRMA (value) CP> D DSWPB (value) CP> D DSWPARITY (Prime 750 only) (value) </pre>
W	<p><u>Warm Start</u></p> <p>Attempt to warm start the machine. Enter this command sequence:</p> <pre> CP> <u>SYSCLR</u> *** CPU VERIFIED *** CP> <u>RUN</u> HALTED AT 001001: 000010 CP> <u>RUN</u> SYSTEM WARM STARTING, PLEASE WAIT ***** WARM START ***** </pre> <p style="text-align: center;"><u>Note</u></p> <p>A warm start may run for 90 seconds or more before the WARM START message appears at the user terminals. It will be slightly longer before a message appears at the supervisor terminal. Do not assume a warm start has failed without waiting 90 seconds and checking the user terminals for the WARM START message.</p> <p>If this fails, no message will be displayed, or the system will halt. In this case, perform a cold start (by action code C, above).</p>

Table 12-2 (continued)
Recovery Procedures

Code	Action
X	<p><u>Uncorrected Memory Parity Error</u></p> <ol style="list-style-type: none"> 1. Type the following and record the results in the logbook: <ul style="list-style-type: none"> CP> <u>D X</u> (value) CP> <u>D A</u> (value) CP> <u>D B</u> (value) 2. Check the value that was printed when you typed D X. <p>If the value for X is 1, perform a cold start by following action code C.</p> <p>If the value for X is not 1, take two steps. First, type RUN:</p> <pre>CP> <u>RUN</u></pre> <pre>HALTED AT 000014/000320: 003776</pre> <pre>CP></pre> <p>Then, when the CP> prompt reappears, perform a warm start by following action code W.</p>

13

50 Series Shutdown

INTRODUCTION

Shutting down a 50 Series Prime system involves simply shutting down the operating system (PRIMOS or PRIMOS II) and then powering down the system in the proper order.

This chapter discusses the following procedures:

- Shutting down the operating system
- Removing system power

SHUTTING DOWN THE OPERATING SYSTEM

The procedure for shutting down the operating system depends upon whether PRIMOS or PRIMOS II is running.

Shutting Down PRIMOS

Before shutting down PRIMOS, you should warn the user community of the impending shutdown. For information on how to do this, see Chapter 22.

To shut down PRIMOS, type the following:

```
OK, SHUTDN ALL
REALLY? YES
WAIT,
PRIMOS NOT IN OPERATION
```

HALTED AT 000006/003525: 003776

CP>

When the "REALLY?" prompt is given, any answer except "YES" aborts the shutdown. If you answer "YES", system power should then be removed, as described in Removing System Power.

Shutting Down PRIMOS II

To shut down PRIMOS II, enter the following command:

```
OK: SHUTDN
OK:
```

Unlike PRIMOS, PRIMOS II will not halt the CPU as a result of this command. However, it is in effect shut down. If you wish to power down the system, do so as described below. If you wish to stop the CPU without shutting off the system power, press the MASTER CLEAR button on the system status panel.

REMOVING SYSTEM POWER

Shut down equipment in the reverse order of system startup:

- Turn off peripheral devices.
- Turn off dataphone sets.
- Turn off all magnetic tape drives.
- Turn off disk drives; wait until all disks have stopped.
- Turn off the CPU.

PART V

The Prime 850

1972

1972

14

Prime 850 Operation

INTRODUCTION

The Prime 850 is a powerful dual-stream computer system, providing the throughput necessary to support large time-shared applications. A standard system consists of two cabinets plus peripheral devices. The two cabinets contain the following components:

- Two five-board instruction stream units (ISU)
- One system synchronization unit (SSU)
- Main memory unit
- Input/output controllers
- Virtual Control Panel (VCP)
- System status panel

The two instruction stream units (ISU) together with the stream synchronization unit (SSU) comprise the Central Processing Unit (CPU).

The system supports a wide variety of peripheral devices such as disks, printers, and terminals.

The operator interacts with the system by using the system status panel (which is located at the top of the cabinet) and by using a supervisor terminal (which may be video or hardcopy). The supervisor terminal is connected to the VCP, which in turn controls operation of the Central Processing Unit (CPU).

This chapter describes the various control functions that are available to the operator through the use of physical control switches and of commands entered at the supervisor terminal.

SYSTEM STATUS PANEL

The system status panel is located on the front door of the Prime computer. Figure 14-1 shows the arrangement of the controls and indicators on the system status panel.

The buttons on the top orange panel of the cabinet control the main functions of the system. The lights above the buttons reflect the current state of the system.

- The SYSTEM POWER button controls the power supplies to all devices in the main cabinet. Pushing this button when power is off turns on the power. This same button is pushed after system shutdown to turn off power.

When the ON light above the SYSTEM POWER button is on, the CPU has power.

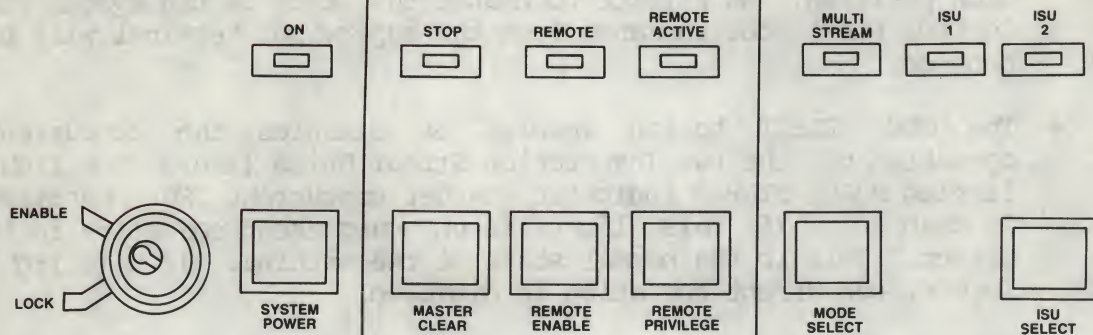
- Pushing and releasing the MASTER CLEAR button halts the CPU if it is running, then places the CPU and peripheral controllers in a properly functioning state.

When the STOP light above the MASTER CLEAR button is on, the CPU has halted.

- The REMOTE ENABLE button permits or denies the use of another terminal (a remote terminal) as a supervisor terminal. Pushing the button allows such a terminal to monitor your system. This feature is used when your Customer Service Representative performs system test and maintenance activities.

When the remote supervisor terminal feature is enabled, the REMOTE light above the button is on.

- The REMOTE PRIVILEGE button determines the access level of the remote supervisor terminal. Pushing the button allows the remote terminal to function as a supervisor terminal. Otherwise, the remote terminal may only monitor the supervisor terminal activity. The remote user should be granted full access only when it is certain that a Customer Service Representative is using the remote terminal.



The Prime 850 Status Panel
Figure 14-1

The REMOTE ACTIVE light above the REMOTE PRIVILEGE button indicates the status of the remote terminal. This light is off when no remote terminal is dialed into the system. When this light is on or blinking, a remote terminal is dialed into the system, and its privilege level is indicated by the behavior of this light.

While this light glows steadily, the remote terminal merely shows what is typed at the local supervisor terminal. If this light is blinking, then the remote terminal is functioning as the supervisor terminal.

- The two-position key switch (ENABLE LOCK) determines whether the three buttons to the far right of it -- MASTER CLEAR, REMOTE ENABLE, and REMOTE PRIVILEGE -- are enabled or disabled. When the switch is in the LOCK position, pushing these buttons will have no effect. Turning the switch to LOCK also prevents anyone from shifting the supervisor terminal between supervisor terminal and Control Panel modes. If the supervisor terminal is already in Control Panel mode, and if the key switch is in the LOCK position, no attempt to change the state of the system via Control Panel mode commands from the supervisor terminal will be honored.
- The MODE SELECT button enables or disables the concurrent operation of the two Instruction Stream Units (ISU). The light labeled MULTI STREAM indicates whether concurrent ISU operation is enabled. If this light is on, concurrent operation is in effect. This is the normal state of the machine. If this light is off, concurrent operation is disabled.

When concurrent operation is enabled, both ISUs operate concurrently while PRIMOS is running. When disabled, only one ISU is running, as indicated by the ISU 1 or ISU 2 indicator.

WARNING

Do not press the MODE SELECT button while the CPU is running. Anomalous behavior will result.

- The ISU SELECT button switches between ISU 1 and ISU 2. If the MULTI STREAM light is off, one of the lights labeled ISU 1 or ISU 2 will indicate which instruction stream unit has been selected. If the MULTI STREAM light is on, pressing the ISU SELECT button will have no immediate effect; but should the MODE SELECT button be subsequently pressed to discontinue concurrent ISU operation, the ISU selected by the ISU SELECT button will be used.

WARNING

Do not press the ISU SELECT button while the CPU is running. Anomalous behavior will result.

THE SUPERVISOR TERMINAL

The supervisor terminal for the Prime computer system is the main link between you and the system's many programs and devices. You will use it for giving instructions to various parts of the system and for receiving and recording information from the system.

The supervisor terminal is not directly connected to the CPU. Instead, it is connected to the VCP. The VCP is a one-board microcomputer that allows the supervisor terminal to function as a supervisor terminal or a control panel. These two operating modes are discussed in more detail below.

Using Supervisor Terminal Modes

The supervisor terminal for the Prime computer can be used in two different operating modes:

- Supervisor Terminal mode (ST)
- Control Panel mode (CP)

This section describes the functions of each mode as well as the methods for changing from one mode to another.

Supervisor Terminal Mode: In ST mode, you can use the terminal for entering any of the special PRIMOS operator commands required for system monitoring and maintenance, as well as for all regular PRIMOS commands. Also, the terminal will display messages informing you of changes in the system's status, such as when users log in or log out.

Supervisor Terminal mode is only available when PRIMOS or PRIMOS II is being started up (booted) or is running. If neither PRIMOS or PRIMOS II is running, the only available mode for the supervisor terminal is CP (Control Panel) mode.

Control Panel Mode: When you start up the Prime computer, the supervisor terminal is automatically set to CP mode. By setting the supervisor terminal to CP mode, you can use it for entering special Control Panel commands. (See Appendix A for a complete list.) Some of these commands are used to perform functions such as booting and master clearing. Others are used for technical procedures usually performed by a Customer Service Representative.

You may enter CP mode from ST mode by pressing the ESCAPE key twice. A CP> prompt will appear, indicating that the terminal will accept only Control Panel commands. No login is required.

The supervisor terminal will automatically be set to CP mode and the CP> prompt will be displayed whenever the system halts, whether the halt is due to an error condition, or during the normal course of system shutdown. (See Chapters 16 and 17 for instructions on using the Control Panel commands in these situations).

You will probably use CP mode most frequently when performing system backups. There are three Control Panel commands that allow you to start up the two available operating systems, PRIMOS and PRIMOS II. These commands are:

SYSCLR	to initialize the CPU before startup
BOOT 14114	to start up PRIMOS
BOOT 10114	to start up PRIMOS II

The two BOOT commands will automatically place the supervisor terminal in ST mode and will start up the operating system.

Changing Terminal Modes

If the key switch is in the unlocked (ENABLE) position, you may change back and forth between modes at will. The following procedures are required for shifting between ST and CP modes:

- To switch from ST to CP mode, press the ESCAPE key twice. The CP> prompt will appear. For example:

```
OK, <ESCAPE><ESCAPE>
CP>
```

You have now placed the supervisor terminal in CP (Control Panel) mode.

- To switch from CP to ST mode, enter the MO ST command. For example:

```
CP> MO ST
```

Controlling Supervisor Terminal Output

If the supervisor terminal is in ST mode, it will normally display (or print) informative messages about various system-related events as these events occur. Such events include logins, logouts, disk errors, and others. In CP mode, however, these messages are not displayed. Instead, the messages are stored in a buffer and then displayed when you re-enter ST mode.

You will rarely need to change the way the system handles status messages. If you should need to change this, use the Control Panel commands SYSOUT INT, SYSOUT IGN, and SYSOUT BUFF to control supervisor terminal output. These commands are fully described in Appendix A.

Recording Supervisor Terminal Activity

If your supervisor terminal is a hardcopy terminal, you will automatically have a printed record of all messages sent to the supervisor terminal and all commands typed at the terminal. However, if your supervisor terminal is a video display unit (VDU), you will have no permanent record of this data unless you take special measures to save it in a command output file. The procedure for doing this is described in Chapter 22.

The following information was obtained from the records of the Department of the Interior, Bureau of Land Management, for the year ending December 31, 1964.

Summary of Land Acquisitions

The following table shows the number of acres of land acquired by the Department of the Interior, Bureau of Land Management, for the year ending December 31, 1964.

Category	Number of Acres
Public Lands	1,234,567
Private Lands	567,890
Total	1,802,457

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Prime 850 Startup

INTRODUCTION

The Prime 850 automatically performs system initialization upon system power-up. Usually, the operator will only have to turn on the equipment and enter three commands for the system to become ready for user login.

Normally, the operator will start up PRIMOS after turning on system power. Sometimes, the operator may want to start up PRIMOS II, rather than starting PRIMOS. Occasionally, the operator may need more control over startup. The Virtual Control Panel (VCP) allows the operator complete control over the startup procedure.

The first section of this chapter describes how to use the VCP to boot PRIMOS or PRIMOS II. The second section describes the actions you should take following a successful system boot. The third section describes alternative booting methods. For a more detailed discussion of system startup, see Chapter 22.

STANDARD SYSTEM STARTUP

This section discusses four operations that require the operator's attention during the standard startup procedure, if PRIMOS is to be started up:

- Turning on power to equipment
- Initiating the PRIMOS system startup
- Monitoring the progress of the startup sequence
- Enabling user login

If PRIMOS II is to be started up, the two operations are:

- Turning on power to equipment
- Initiating the PRIMOS II system startup

Turning on Power to Equipment

Turn on power to the equipment in this order:

1. Turn on the power to the supervisor terminal.
2. Be sure the front panel key switch on the system status panel is set to ENABLE.
3. Turn on the SYSTEM POWER switch on the system status panel.
4. Turn on the power to the disk drives and wait for the disk drives to become ready. (When the disk drives are ready, the READY lights remain steadily lit.)
5. If needed for immediate use, turn on other peripheral devices such as printers and tape drives.

Note

A system may be connected to more than one tape drive or line printer through controllers. In order for any tape drive or line printer on a controller to function, all tape drives or line printers on that controller must be turned on.

Initiating System Startup

When you turn on the SYSTEM POWER switch, the VCP automatically verifies and initializes VCP and CPU operation. This procedure includes these three main operations:

- Power is supplied to all devices in the cabinet.
- VCP circuits are tested for correct operation.
- CPU and controller circuits are tested for correct operation.

This procedure is controlled by the VCP, and it takes about four seconds to complete. During the VCP verification procedure, the REMOTE and REMOTE ACTIVE lights on the system status panel will indicate the progress of the verification procedure, as follows:

<u>REMOTE</u>	<u>REMOTE ACTIVE</u>	<u>TEST</u>
OFF	ON	Dynamic memory test
ON	OFF	Serial ports test
ON	ON	High speed buffer and mapper test

The STOP light will be on during this procedure.

After the VCP is verified, and as the CPU is being verified, the supervisor terminal will display messages that tell you the results of the verification process, as follows:

VCP.04 11-09-79

*** CPU VERIFIED ***

CP>

At this point, enter the appropriate BOOT command to start up the PRIMOS or PRIMOS II operating system, as follows:

CP> BOOT 14114 (to start up PRIMOS)

or:

CP> BOOT 10114 (to start up PRIMOS II)

This initiates the system startup process.

Monitoring the System Startup Process

As the system starts up, the supervisor terminal will display messages that tell you what the system is doing. For example:

```
PRIMOS II REV 19.1 11/22/82 (AT 170000)
STARTING UP DISK 001060
```

If you used the BOOT 10114 command to start up PRIMOS II, the OK: prompt will be issued at this point, and the startup procedure will have completed.

If you used the BOOT 14114 command to start up PRIMOS, the startup procedure will continue and more messages relating to the system startup procedure will be displayed. The actual terminal display depends on the system's configuration, but a series of messages will look something like this:

```
PRIMOS
A PRIRUN
/* C_PRMO, CMDNCO, WAC, 04/01/83
/* C_PRMO FILE FOR BRINGING UP PRIMOS
/*
CONFIG -DATA CONFIG
PRIMOS 19.2
```

8192K BYTES MEMORY IN USE

Starting up revision 19 partition "IM".
Beginning Network Initialization.

NETMAN (user 122) logged in Wednesday, 06 Apr 83 10:04:57.
NETWORK INITIALIZED.

Please enter date and time.

OK, ADDISK 1060 21060 41060 61060

Starting up revision 19 partition "IM".

Starting up revision 19 partition "ZAPHOD".

.
.
.

OK, /* ENTER SETIME COMMAND TO SET DATE AND TIME, THEN

OK, /* ENTER THE MAXUSR COMMAND TO ENABLE LOGIN

OK, COMINPUT -END

OK,

When the automated startup procedure has finished, the PRIMOS prompt OK, appears at the supervisor terminal, along with a reminder of the additional steps the operator must take to allow other users to log in.

Enabling User Login

After PRIMOS is ready, the operator must perform the following two steps before other users will be able to log in and use the system:

1. Enter the date and time using the SETIME command (or its abbreviation, SE).
2. Enable user login using the MAXUSR command (or its abbreviation, MAX).

Setting the Date and Time: To set the date and time, you enter the SETIME command at the supervisor terminal. Use the following command format:

```
SETIME -mmddyy -hhmm
```

Here, mmddyy is the date and hhmm is the time in 24-hour format. For example, to set the date and time to April 20, 1983, 10:38 p.m., you would enter the command:

```
SETIME -042083 -2238
```

Enabling User Login: To allow users to log in, you enter the MAXUSR command at the supervisor terminal. Use the following command format:

```
MAXUSR [n]
```

Normally, you would omit n, allowing as many users to log in as is permitted by the system configuration. If you specify n, you set the maximum number of users allowed to be logged in at one time.

As soon as you enter the MAXUSR command, the following message will be displayed at all user terminals:

```
Login please.  
OK,
```

19.2

After this, as long as the number of users does not exceed the current setting of MAXUSR, users will be able to log in and use the system.

Note

When MAXUSR is first entered after a system coldstart, two actions occur. First, the maximum number of allowable users is set to n (if specified); second, user login is enabled and the login message is sent to user terminals.

When MAXUSR is entered at any other time, only the first action occurs.

If Problems Occur During Standard System Startup

If the standard system startup procedure fails to work as expected, you should inform the System Administrator. Enter a complete description of the problem in the system logbook. (Include any messages that might be displayed or printed at the supervisor terminal.) Messages that indicate potentially serious problems with the system are:

\$\$\$ VCP DID NOT VERIFY \$\$\$
 \$\$\$ CPU NOT VERIFIED \$\$\$

If one of these messages appears, try issuing a VIRY command once or twice, and then try powering the system off and on again. This procedure may fix the problem. If not, such a message usually indicates a VCP or CPU circuit failure that must be corrected by a Customer Service Representative.

If no messages appear at the supervisor terminal, the startup sequence has stopped for a reason the VCP can't diagnose. The system is then in a "hung" condition. In this case you may be able to solve this condition by pushing the MASTER CLEAR button. If this does not clear the condition, try turning the power off, then on again. If the system still does not start, or if the problem recurs, contact your Customer Service Representative.

AFTER SYSTEM STARTUP

After the system is up and running, you should turn on any other devices. Such devices may include the following:

- Magnetic tape drives
- Dataphone sets on automatic answer
- Other peripheral devices such as line printers

In addition, you should start up any subsystems that were not started during normal system startup. For more information, see Chapter 22.

ALTERNATE STARTUP METHODS

The standard startup method is adequate in most cases. However, there are times when it is necessary to start up the system in another way. This is referred to as an alternate startup method.

When you use the standard startup method, the VCP command BOOT 14114 or BOOT 10114 is used to start up PRIMOS or PRIMOS II, respectively. This command includes information that tells the computer what combination of devices and programs to use for the bootstrap procedure.

The BOOT 14114 command includes the following set of instructions:

- Use the first disk drive.
- Use the first controller.
- Use the top disk partition.
- Boot the PRIMOS operating system.

Occasionally, you may need to boot the system in a different way from the standard method. For example, if your system's main disk drive develops problems, you might want to boot from a magnetic tape.

In situations such as these, you must issue a variant of the BOOT command. Along with the BOOT command, you enter a boot number that determines how the bootstrap proceeds. For some methods of bootstrapping you also must enter the disk partition's physical device number.

Information on the boot number may be found in Appendix E. Information on determining physical device numbers may be found in Volume II of this book.

General Procedure for Using Alternate Startup Methods

To start up PRIMOS or PRIMOS II in a non-standard fashion, such as from a disk on the second disk controller, use the BOOT command as follows:

1. Determine the BOOT number for the device to be booted. Also find the partition's physical device number, if required.
2. Turn on the power, as for standard startup.
3. Issue the appropriate BOOT command when you see the following message:

*** CPU VERIFIED ***

Appendix E describes how to construct the number used for the BOOT command.

4. If PRIMOS is started up, issue the SETIME and MAXUSR commands (described above) to allow users to log in.

16

Prime 850 Halts and Hangs

INTRODUCTION

The Prime 850 is designed to give reliable, efficient service under a wide range of conditions. However, after certain hardware or software failures the system may unexpectedly stop functioning ("halt" or "hang"). If this happens, the operator has the dual responsibilities of restoring service to users and of recording information on the cause of the failure.

This chapter defines recovery procedures for the operator to follow in case of a system halt or hang. The first section describes how to recognize different types of halts and hangs and how to recover from halts or hangs that occur under PRIMOS II or while booting. The second and third sections describe how to handle PRIMOS hangs and halts.

Caution

Never use the MASTER CLEAR button or the SYSCLR and VIRY commands before you have recorded the halt location in the system logbook and have determined all the recovery actions you will be performing. Some recovery actions will be ineffective unless they are taken before using MASTER CLEAR, SYSCLR, or VIRY.

RECOGNIZING HALTS AND HANGS

If the Prime 850 suddenly stops working, your first task is to determine whether the problem is a halt or a hang and then which operating system was active when the problem occurred. This information will help you choose the proper recovery procedures.

Halts Versus Hangs

These are indications that a halt has occurred:

- The STOP light on the front panel is on, indicating that the CPU is not running.
- A halt message is displayed at the supervisor terminal. For example:

HALTED AT 000004/000316: 003776

- The supervisor terminal is placed in Control Panel (CP) mode, as indicated by the CP> prompt.

These are indications that a hang has occurred:

- The STOP light on the front panel is off, but the CPU is unresponsive to commands from user terminals from or the supervisor terminal.
- No halt message is displayed at the supervisor terminal.
- The supervisor terminal may or may not function in Control Panel (CP) mode.

Operating System Dependencies

The actions taken at this point depend on whether PRIMOS or PRIMOS II was running at the time of the halt or hang.

When PRIMOS is being started up, it is considered running as soon as the following message appears at the supervisor terminal:

PRIMOS 19.2

When PRIMOS II is being started up, it is considered running as soon as this message is printed at the supervisor terminal:

PRIMOS II REV 19.1 11/22/82 (AT 170000)

If PRIMOS Is in Control: Perform the procedures in Handling Hangs Under PRIMOS or Handling Halts Under PRIMOS, below.

If PRIMOS II Is in Control: If the CPU is hung, halt the system by pressing the MASTER CLEAR button on the system status panel.

If the CPU is already halted, or after you halt it, enter the following VCP commands to attempt to restart PRIMOS II:

```
SYSCLR
RUN 170000
```

This restarts PRIMOS II. It should respond with the prompt OK:. If it does not, try the following command sequence:

```
SYSCLR
BOOT 10114
```

This starts up a fresh copy of PRIMOS II. If PRIMOS II does not produce its introductory message within about 20 seconds, make certain that the system disks are working and ready. If there are still problems, contact your System Administrator.

If Neither Operating System Is in Control: If the halt or hang occurred while PRIMOS or PRIMOS II was being booted, check all system disks to make sure they are operational. Then retry the VCP command sequence to start up PRIMOS or PRIMOS II. If problems persist, contact your System Administrator.

Note

The remainder of this chapter assumes that PRIMOS was in control at the time of the halt or hang.

HANDLING HANGS UNDER PRIMOS

Follow these steps in handling hangs under PRIMOS:

1. Note in the system logbook that a hang occurred and give the time and date when it happened.
2. Try to halt the CPU by setting the supervisor terminal to Control Panel mode and giving the STOP command. If this works, the front panel STOP light will go on and a halt message will appear at the supervisor terminal.

For example:

<ESCAPE><ESCAPE>
CP> STOP

HALTED AT 000006/015555: 140734

CP>

If entering the STOP command does not work, press the MASTER CLEAR button on the system status panel. If this does not stop the system, turn the system power off and then on again. The system should initialize and place the supervisor terminal in CP mode. Start up PRIMOS, as described in Chapter 15, using the SYSCLR and BOOT 14114 commands. (If the system has been powered off and then on again, do not perform steps 3 and 4.)

3. If requested by Customer Service, or if repeated hangs have occurred, perform a memory to tape dump. For instructions, see Table 16-2, code D.
4. Restart the system by entering the VCP commands SYSCLR and BOOT 14114.
5. Record all hang-handling actions you take and their results in the system logbook.

HANDLING HALTS UNDER PRIMOS

Since it has two instruction stream units (ISUs), the Prime 850 requires a special halt handling procedure. The steps in this procedure are as follows:

1. Determine which instruction stream has halted. This is done by typing the following:

A 4/176106

If the number displayed is 000004/176106: 041004, the halt has occurred in stream 1.

If the number displayed is 000004/176106: 102010, the halt has occurred in stream 2.

2. Reset the VCP to accept the next command by typing a slash:

/

3. Determine the location of the halt.

Stream 1 Halts: If the halt has occurred in stream 1, the halt location will be displayed in the message:

HALTED AT segno/wordno: contents

Proceed to step 8.

Stream 2 Halts: If the halt has occurred in stream 2, proceed as described in the following steps.

4. Do not do a SYSCLR prior to executing the following procedure. Determine the halt address by typing the following:

A 14/2516 (CR)
(CR)

The two numbers displayed will give the stream 2 halt address.

5. Reset the VCP to accept the next command by typing a slash:

/

6. Determine the DSWPARITY (Diagnostic Status Word PARITY) error information by typing this the following:

A 14/2556 (CR)
(CR)

The two numbers displayed will give the stream 2 DSWPARITY error information.

7. Reset the VCP to accept the next command by typing a slash:

/

The following example shows the correct method for handling a stream 2 halt:

CP> A 4/176106	CR	
000004/176106: 102010	/	
CP> A 14/2516	CR	
000014/002516: xxxxxx	CR	ISU-2 halt
000014/002517: yyyyyy	/	address
CP> A 14/2556	CR	
000014/002556: xxxxxx	CR	ISU-2 DSWPARITY
000014/002557: yyyyyy	/	value
CP>		

8. Record the complete halt message in your system logbook, the stream that halted, and the halt address of that stream, along with the time and date of the halt.

9. Examine the halt address determined earlier.
10. Look up the halt address in Table 16-1 and determine what actions codes to use for recovery.
11. Perform the appropriate recovery procedures by using the instructions in Table 16-2. Always perform action code procedures in the order indicated in Table 16-1, so that diagnostic data from the memory and CPU will be obtained before the state of the system is changed by a restart procedure.
12. Record all halt-handling actions and their results in the system logbook. This information will help a System Analyst or Customer Service Representative determine the cause of the halt.

If you cannot get the system running again by following the procedures in this chapter, or if halts or hangs recur, consult your Customer Service Representative.

Table 16-1
Action Codes for Halts

Halt Address	Action Codes
000004/000277	X
000004/000306	R, D, then W
000004/000316	D, then C
All others	D, then W

Table 16-2
Recovery Procedures

Code	Action
C	<p><u>Cold Start</u></p> <p>Enter the VCP command sequence:</p> <p>CP> <u>SYSCLR</u></p> <p>*** CPU VERIFIED ***</p> <p>CP> <u>BOOT 14114</u></p>
D	<p><u>Crash Magnetic Tape Dump</u></p> <p>If requested by your Customer Service Representative, or if the system repeatedly halts or hangs, perform the following steps:</p> <ol style="list-style-type: none"> 1. Mount an available tape on a drive unit (unit number 1). Make sure the write ring is in place, and the drive unit is set on line. 2. Type: <p>CP> <u>SYSCLR</u></p> <p>*** CPU VERIFIED ***</p> <p>CP> <u>RUN 776</u></p> <p>If unit number 1 is not available, you may mount the tape on unit number 0 and use the RUN 775 command instead of RUN 776 in the above command sequence.</p> 3. The tape will write necessary information and then rewind. This procedure is called a tape dump. If the tape does not rewind, repeat the procedure. Label the tape with the date and time of the halt and, if needed, the machine identification. Record the dump in the logbook, and give the tape to the person responsible for examining unusual halts.

Table 16-2 (continued)
Recovery Procedures

Code	Action
R	<p><u>Record Register Settings</u></p> <p>Type the following, and record the output in the logbook:</p> <pre> CP> <u>D DSWSTAT</u> (value) CP> <u>D DSWRMA</u> (value) CP> <u>D DSWPB</u> (value) CP> <u>D DSWPARITY</u> (value) </pre>
W	<p><u>Warm Start</u></p> <p>Attempt to warm start the machine. Enter this command sequence:</p> <pre> CP> <u>SYSCLR</u> *** CPU VERIFIED *** CP> <u>RUN</u> HALTED AT 001001: 000010 CP> <u>RUN</u> SYSTEM WARM STARTING, PLEASE WAIT ***** WARM START ***** </pre> <p><u>Note</u></p> <p>A warm start may run for 90 seconds or more before the WARM START message appears at the user terminals. It will be slightly longer before a message appears at the supervisor terminal. Do not assume a warm start has failed without waiting 90 seconds and checking the user terminals for the WARM START message.</p>

Table 16-2 (continued)
Recovery Procedures

Code	Action						
<p data-bbox="842 427 911 454" style="text-align: center;"><u>Note</u></p> <p data-bbox="515 488 1238 546">The following message may appear during the warm start procedure:</p> <p data-bbox="579 577 1107 638"> ***** WARNING ***** 2ND INSTRUCTION STREAM NOT IN USE. </p> <p data-bbox="515 674 1238 797">This message indicates that only one ISU is in operation. The system will function correctly, but at a reduced performance level. Contact your System Administrator.</p> <p data-bbox="453 860 1300 954">If the warm start attempt fails, no message will be displayed, or the system will halt. In this case, perform a cold start (by action code C, above).</p>							
X	<p data-bbox="453 1077 938 1104"><u>Uncorrected Memory Parity Error</u></p> <ol style="list-style-type: none"> <li data-bbox="453 1140 1300 1198">1. Type the following and record the results in the logbook: <table data-bbox="576 1234 1107 1328"> <tr> <td>CP> <u>D X</u></td><td>(value)</td></tr> <tr> <td>CP> <u>D A</u></td><td>(value)</td></tr> <tr> <td>CP> <u>D B</u></td><td>(value)</td></tr> </table> <li data-bbox="453 1357 1300 1415">2. Check the value that was printed when you typed D X. <p data-bbox="515 1451 1300 1509">If the value for X is 1, perform a cold start by following action code C.</p> <p data-bbox="515 1545 1300 1603">If the value for X is not 1, take two steps. First, type RUN:</p> <p data-bbox="576 1639 691 1666">CP> <u>RUN</u></p> <p data-bbox="576 1697 1062 1724">HALTED AT 000014/000320: 003776</p> <p data-bbox="576 1760 627 1787">CP></p> <p data-bbox="515 1823 1300 1881">Then, when the CP> prompt reappears, perform a warm start by following action code W.</p> 	CP> <u>D X</u>	(value)	CP> <u>D A</u>	(value)	CP> <u>D B</u>	(value)
CP> <u>D X</u>	(value)						
CP> <u>D A</u>	(value)						
CP> <u>D B</u>	(value)						

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Prime 850 Shutdown

INTRODUCTION

Shutting down the Prime 850 involves simply shutting down the operating system (PRIMOS or PRIMOS II) and then powering down the system in the proper order.

This chapter discusses the following procedures:

- Shutting down the operating system
- Removing system power

SHUTTING DOWN THE OPERATING SYSTEM

The procedure for shutting down the operating system depends upon whether PRIMOS or PRIMOS II is running.

Shutting Down PRIMOS

Before shutting down PRIMOS, you should warn the user community of the impending shutdown. For information on how to do this, see Chapter 22.

To shut down PRIMOS, type the following:

```
OK, SHUTDN ALL  
REALLY? YES  
WAIT,  
PRIMOS NOT IN OPERATION
```

HALTED AT 000006/003525: 003776

CP>

When the "REALLY?" prompt is given, any answer except "YES" aborts the shutdown. If you answer "YES", system power should then be removed, as described in Removing System Power.

Shutting Down PRIMOS II

To shut down PRIMOS II, enter the following command:

```
OK: SHUTDN  
OK:
```

Unlike PRIMOS, PRIMOS II will not halt the CPU as a result of this command. However, it is in effect shut down. If you wish to power down the system, do so as described below. If you wish to stop the CPU without shutting off the system power, press the MASTER CLEAR button on the system status panel.

REMOVING SYSTEM POWER

Shut down equipment in the reverse order of system startup:

- Turn off peripheral devices.
- Turn off dataphone sets.
- Turn off all magnetic tape drives.
- Turn off disk drives; wait until all disks have stopped.
- Turn off the CPU.

PART VI

The Prime 400

PART VI

The Prince (10)

18

Prime 400 Operation

INTRODUCTION

The Prime 400 family includes the Prime 350, 400, and 500 computer systems. These earlier models of Prime equipment are identifiable by the control panel extending from the center of the unit. The control panel has a lock, twenty toggle switches, seventeen indicator lights (16 address/data and one stop indicator), and a large rotary switch.

A standard Prime 400 system consists of a cabinet plus peripheral devices. The cabinet contains the following components:

- Multi-board Central Processing Unit (CPU)
- Main memory unit
- Input/output controllers
- Control Panel (CP)

The system supports a wide variety of peripheral devices such as disks, printers, and terminals.

The operator interacts with the system by using the control panel (which is located on the front of the cabinet) and by using a supervisor terminal (which may be video or hardcopy).

This chapter describes the various control functions that are available to the operator through the combined use of physical control switches and commands entered at the supervisor terminal.

CONTROL PANEL

The control panel is located on the front of the Prime 400. Figure 18-1 shows the arrangement of the controls and indicators on the control panel.

- The keyswitch has three settings: OFF, ON, and LOCK. The OFF position removes power from the devices in the main cabinet. The ON position supplies power to all devices in the main cabinet. The LOCK is similar to the ON position, and it also locks the other switches on the panel.
- The ROTARY switch selects the operating mode of the CPU. It is used to indicate whether the current program is to be run (RUN position), a new program is to be loaded (LOAD position), the CPU is to be stopped (STOP/STEP position), or memory data is to be examined and/or modified (the remaining positions).

In general, changing the setting of the rotary knob does not in itself cause any immediate change in system behavior. The exception is that if the rotary knob is in the RUN or LOAD positions, and the CPU is running (as indicated by an unlit STOP light), turning the rotary knob to STOP/STEP or beyond will immediately stop the CPU. In other cases, switches are used to perform functions indicated by the position of the rotary knob.

See Appendix A for a complete discussion of the rotary knob positions.

- The MASTER CLEAR switch is used to initialize memory and input/output controllers, and to verify the CPU. This switch is normally in the UP position. When it is pressed down, it will cause the CPU, memory, and input/output controllers to be initialized. After the switch is released, it will automatically return to the UP position. This switch is only operational while the rotary knob is in a position other than RUN or LOAD.
- The ADDRESS/DATA switch specifies whether the sixteen lights display the current system address or the system data register. In addition, while the rotary knob is set to a position other than RUN or LOAD, the position of this switch determines whether the address or data register is modified by the sense switches and the DATA CLEAR switch.

In the UP position, the system address register is selected in the lights, and it is the target of sense switch and DATA CLEAR operations when the rotary knob is in a position other than RUN or LOAD.



The Prime 400 Family Control Panel
Figure 18-1

In the DOWN position, the system data register is selected in the lights, and it is the target of sense switch and DATA CLEAR operations when the rotary knob is in a position other than RUN or LOAD.

- The row of SENSE SWITCHES, labeled from 1 to 16, has two uses depending upon the position of the rotary knob: they set the system address or data register while the rotary knob is in a position other than RUN or LOAD, and they provide information to running programs while the rotary knob is in the RUN or LOAD position.

Each switch has three positions, UP, DOWN, and SET. The UP position is used to set the corresponding bit in the sense switch register as seen by programs that are running on the CPU. In addition, the UP position is used by the control panel, while the rotary knob is in a position other than RUN or LOAD, to provide additional addressing information.

The DOWN position is the normal position for the sense switches. It resets the corresponding bit in the sense switch register as seen by running programs.

The SET position, below the DOWN position, is a momentary position for the switch. Holding a switch in the SET position sets the corresponding bit in the data switch register as seen by running programs. If the rotary knob is not in the RUN or LOAD position, then holding a switch in the SET position sets the corresponding bit in the system address or data register, depending upon the setting of the ADDRESS/DATA switch.

The information provided by the sense switches is entered in binary format. To enable the operator to easily convert octal numbers to binary, the shaded portions above the sense switches divide the 16-bit binary quantity into one 1-bit digit followed by five 3-bit digits.

- The lights above the sense switches indicate the contents of either the system address or data register, as specified by the position of the ADDRESS/DATA switch. While the rotary knob is in the RUN or LOAD position, these lights indicate either the address currently being referenced by the CPU or input/output controllers, or the data register as set by the running program.

While the rotary knob is in a position other than RUN or LOAD, these lights display the system address register or the system data register. These registers are used to set up operations involving the current setting of the rotary switch. To set bits in these registers, move the corresponding sense switch to the SET position, and the light above it will ignite. To reset bits in these registers, press and release the DATA CLEAR switch, and all of the lights above the sense switches will be extinguished.

- The DATA CLEAR switch is used to clear either the system address or data register, depending upon the setting of the ADDRESS/DATA switch. The DATA CLEAR switch is only operational while the rotary switch is not in the RUN or LOAD position. Hold the switch down momentarily to clear the register.
- The START switch starts the CPU. When you press and release this switch, the rotary switch selects the operation performed by the CPU. In the RUN position, the program is started. In the LOAD position, the boot process is initiated. In the STOP/STEP position, one instruction of the program is executed, and the CPU stops again.

For complete information on the Prime 400 control panel, see Appendix D.

THE SUPERVISOR TERMINAL

The supervisor terminal for the Prime computer system is the main link between you and the system's many programs and devices. You will use it for giving instructions to various parts of the system, and for receiving and recording information from the system.

Using the Supervisor Terminal

The supervisor terminal may be used to enter any of the special PRIMOS operator commands required for system monitoring and maintenance, as well as all regular PRIMOS commands. Also, the terminal will display messages informing you of changes in the system's status, such as when users log in or log out.

The supervisor terminal is only operational when PRIMOS or PRIMOS II is running or being started up (booted). If neither PRIMOS or PRIMOS II is running, the supervisor terminal will not respond to input.

Recording Supervisor Terminal Activity

If your supervisor terminal is a hardcopy terminal, you will automatically have a printed record of all messages sent to the supervisor terminal and all commands typed at the terminal. These messages describe events such as logins, logouts, and disk errors.

However, if your supervisor terminal is a video display unit (VDU), you will have no permanent record of this data unless you take special measures to save it in a command output file. The procedure for doing this is described in Chapter 22.

The first part of the document discusses the importance of maintaining accurate records of all transactions. It emphasizes that proper record-keeping is essential for the integrity of the financial system and for the ability to detect and prevent fraud. The document also notes that records should be kept for a sufficient period of time to allow for a thorough review if necessary.

In addition, the document highlights the need for transparency and accountability in all financial dealings. It states that all transactions should be clearly documented and that the responsible parties should be identified. This helps to ensure that there is no ambiguity or confusion regarding the flow of funds and the use of resources.

Overall, the document stresses the importance of a strong internal control system and the role of accurate record-keeping in achieving this goal.

3. Internal Control System

The internal control system is a set of policies and procedures designed to ensure the reliability of financial reporting, the efficiency of operations, and the compliance of the organization with applicable laws and regulations. It is a critical component of any organization's risk management framework.

4. Risk Management Framework

The risk management framework is a systematic approach to identifying, assessing, and managing the risks that an organization faces. It involves the development of a risk appetite statement, the identification of risks, the assessment of their potential impact, and the implementation of controls to mitigate or avoid them.

By implementing a robust risk management framework, an organization can better understand its exposure to various risks and take proactive measures to reduce the likelihood of adverse events occurring.

5. Conclusion

In conclusion, the document outlines the key principles and practices that underpin a strong internal control system, a comprehensive risk management framework, and accurate record-keeping. These elements are essential for ensuring the financial health and operational success of any organization.

The document also provides a clear framework for the implementation and ongoing monitoring of these systems. It emphasizes the importance of regular reviews and updates to ensure that the controls remain effective and relevant in the face of changing circumstances.

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Prime 400 Startup

INTRODUCTION

The Prime 400 family of computer systems automatically perform CPU verification and initialization upon system power-up. The operator will normally turn on the equipment, set the sense switches to appropriate positions, select the LOAD position on the rotary knob, and press the START switch to initiate the system startup process. The operator will then enter two commands for the system to become ready for user login.

Normally, the operator will start up PRIMOS after turning on system power. Sometimes, the operator may want to start up PRIMOS II rather than PRIMOS. Occasionally, the operator may need more control over startup. The control panel allows the operator complete control over the startup procedure.

The first section of this chapter describes how to use the control panel to boot PRIMOS or PRIMOS II. The second section describes the actions you should take following a successful system boot. The third section describes alternative booting methods. For a more detailed discussion of system startup, see Chapter 22.

STANDARD SYSTEM STARTUP

This section discusses four operations that require the operator's attention during the standard startup procedure, if PRIMOS is to be started up:

- Turning on power to equipment
- Initiating the PRIMOS system startup
- Monitoring the progress of the startup sequence
- Enabling user login

If PRIMOS II is to be started up, the two operations are:

- Turning on power to equipment
- Initiating the PRIMOS II system startup

Turning on Power to Equipment

Turn on power to the equipment in this order:

1. Turn on the power to the supervisor terminal.
2. Be sure the front panel key switch on the system status panel is set to ENABLE.
3. Turn on the CPU.
4. Turn on the power to the disk drives and wait for the disk drives to become ready. (When the disk drives are ready, the READY lights remain steadily lit.)
5. If needed for immediate use, turn on other peripheral devices such as printers and tape drives.

Note

A system may be connected to more than one tape drive or line printer through controllers. In order for any tape drive or line printer on a controller to function, all tape drives or line printers on that controller must be turned on.

Initiating System Startup

When you turn on the SYSTEM POWER switch, the CPU is automatically verified and initialized. This procedure includes these two main operations:

- Power is supplied to all devices in the cabinet.
- CPU and controller circuits are tested for correct operation.

This procedure takes about half a second to complete.

After the CPU is verified, the STOP light will be on. At this point, you set the sense switches to the appropriate BOOT setting (as described below) to start up the PRIMOS or PRIMOS II operating system, as follows:

- Sense switches 4, 5, 10, 13, and 14 in the UP position, all others in the DOWN position, will start up PRIMOS.
- Sense switches 4, 10, 13, and 14 in the UP position, all others in the DOWN position, will start up PRIMOS II.

After you have set the sense switches, set the rotary knob to the LOAD position, press the START switch down, and release it. This initiates the system startup process.

At this point, you may set the rotary knob to the RUN position. If you leave PRIMOS in the LOAD position, and you leave the sense switches set to the current setting, then PRIMOS will be automatically booted if system power is lost and then restored.

Monitoring the System Startup Process

As the system is started up, the supervisor terminal will display messages that tell you what the system is doing. For example:

```
PRIMOS II REV 19.1 11/22/82 (AT 170000)
STARTING UP DISK 001060
```

If you used the sense-switch setting to start up PRIMOS II, the OK: prompt will be issued at this point, and the startup procedure will have completed.

If you used the sense-switch setting to start up PRIMOS, the startup procedure will continue, and display more messages relating to the system startup procedure. The actual terminal display depends on the system's configuration, but will include a series of messages something like this:

```
PRIMOS
A PRIRUN
/* C_PRMO, CMDNC0, WAC, 04/01/83
```



```

/* C_PRMO FILE FOR BRINGING UP PRIMOS
/*
CONFIG -DATA CONFIG
PRIMOS 19.2

```

2048K BYTES MEMORY IN USE

Starting up revision 19 partition "IM".
Beginning Network Initialization.

NETMAN (user 122) logged in Wednesday, 06 Apr 83 10:04:57.
NETWORK INITIALIZED.

Please enter date and time.

OK, ADDISK 1060 21060 41060 61060

Starting up revision 19 partition "IM".

Starting up revision 19 partition "ZAPHOD".

.

.

.

OK, /* ENTER SETIME COMMAND TO SET DATE AND TIME, THEN

OK, /* ENTER THE MAXUSR COMMAND TO ENABLE LOGIN

OK, COMINPUT -END

OK,

When the startup procedure has finished, the PRIMOS prompt OK, appears at the supervisor terminal, along with a reminder of the additional steps the operator must take to allow other users to log in.

Enabling User Login

After PRIMOS is ready, the operator must perform the following two steps before other users will be able to log in and use the system:

19.2

1. Enter the date and time using the SETIME command (or its abbreviation, SE).
2. Enable user login using the MAXUSR command (or its abbreviation, MAX).

Setting the Date and Time: To set the date and time, you enter the SETIME command at the supervisor terminal. Use the following command format:

SETIME -mmddyy -hhmm

Here, mmddyy is the date and hhmm is the time in 24-hour format. For example, to set the date and time to April 20, 1983, 10:38 p.m., you would enter the command:

SETIME -042083 -2238

Enabling User Login: To allow users to log in, you enter the MAXUSR command at the supervisor terminal. Use the following command format:

MAXUSR [n]

Normally, you would omit n, allowing as many users to login as is permitted by the system configuration. If you specify n, you set the maximum number of users allowed to be logged in at one time.

As soon as you enter the MAXUSR command, the following message will be displayed at all user terminals:

Login please.
OK,

19.2

After this, as long as the number of users does not exceed the current setting of MAXUSR, users will be able to log in and use the system.

Note

When MAXUSR is first entered after a system coldstart, two actions occur. First, the maximum number of allowable users is set to n (if specified); second, user login is enabled and the login message is sent to user terminals.

When MAXUSR is entered at any other time, only the first action occurs.

If Problems Occur During Automated Startup

If the startup procedure fails to work as expected, you should inform the System Administrator. Enter a complete description of the problem in the system logbook. (Include any messages that might be displayed or printed at the supervisor terminal.)

Failure of the system to properly start up may indicate an incorrect sense switch setting or system configuration. However, it may indicate a CPU circuit failure that must be corrected by a Customer Service Representative.

If no messages appear at the supervisor terminal, the startup sequence has stopped for some reason. The system is then in a "hung" condition. In this case you may be able to clear the condition by setting the rotary knob to the STOP/STEP position and pushing the MASTER CLEAR button. If this does not clear the condition, try turning the power off, then on again. If the system still does not start, or if the problem recurs, contact your Customer Service Representative.

AFTER SYSTEM STARTUP

After the system is up and running, you should turn on any other devices. Such devices may include the following:

- Magnetic tape drives
- Dataphone sets on automatic answer
- Other peripheral devices such as line printers

In addition, you should start up any subsystems that were not started during normal system startup. For more information, see Chapter 22.

ALTERNATE STARTUP METHODS

The standard startup method is adequate in most cases. However, there are times when it is necessary to start up the system in another way. This is referred to as an alternate startup method.

When you use the standard startup method, the sense-switch setting used to start up PRIMOS or PRIMOS II includes information that tells the computer what combination of devices and programs to use for the bootstrap procedure. The setting used for starting up PRIMOS includes the following set of instructions.

- Use the first disk drive.
- Use the first controller.
- Use the top disk partition.
- Boot the PRIMOS operating system.

Occasionally, you may need to boot the system in a different way from the standard method. For example, if your system's main disk drive develops problems, you might want to boot from a magnetic tape.

In situations such as these, you must use a different sense-switch setting. For some methods of bootstrapping you also need to enter the disk partition's physical device number.

Information on the boot number may be found in Appendix E. Information on determining physical device numbers may be found in Volume II of this book.

General Procedure for Using Alternate Startup Methods

To start up PRIMOS or PRIMOS II in a non-standard fashion, such as from a disk on the second disk controller, start up the system as follows:

1. Determine the sense-switch setting for the device to be booted. Also find the partition's physical device number, if required.
2. Turn on the power, as for standard startup.
3. Boot the system setting the sense switches to the setting determined in step 1, setting the rotary knob to the LOAD position, and pressing the START switch. See appendix E for information on how to set the sense switches.

At this point, you may set the rotary knob to the RUN position. If you leave PRIMOS in the LOAD position, and you leave the sense switches set to the current setting, then PRIMOS will be automatically booted if system power is lost and then restored.

4. If PRIMOS is started up, issue the SETIME and MAXUSR commands (described above) to allow users to log in.

THE HISTORY OF THE UNITED STATES

TO THE HISTORY OF THE UNITED STATES, FROM THE FIRST SETTLEMENTS TO THE PRESENT TIME, BY J. W. FULTON, ESQ., OF NEW-YORK.

THE FIRST PART, CONTAINING THE HISTORY OF THE UNITED STATES, FROM THE FIRST SETTLEMENTS TO THE PRESENT TIME, BY J. W. FULTON, ESQ., OF NEW-YORK.

IN TWO VOLUMES. VOL. I.

THE HISTORY OF THE UNITED STATES, FROM THE FIRST SETTLEMENTS TO THE PRESENT TIME, BY J. W. FULTON, ESQ., OF NEW-YORK. THE FIRST PART, CONTAINING THE HISTORY OF THE UNITED STATES, FROM THE FIRST SETTLEMENTS TO THE PRESENT TIME, BY J. W. FULTON, ESQ., OF NEW-YORK.

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20

Prime 400 Halts and Hangs

RECOGNIZING HALTS

Under certain unusual circumstances when hardware or software malfunctions, PRIMOS will execute the HLT instruction and halt. A system halt is indicated by a red light directly above the rotary switch on the control panel.

It is also possible for the machine to "hang." In this case, the machine appears to have halted, but the red light is not on. Hung machines may be identified by the fact that no input or output is taking place at any peripheral equipment, including the supervisor terminal.

When a machine hangs, turn the rotary switch to STOP/STEP to stop the machine. Then treat it like a halted machine.

GENERAL GUIDELINES FOR HANDLING HALTS

When a halt occurs, the operator has two duties:

- Get the system running again as quickly as possible.
- Record enough information so that an analyst can determine why the halt occurred. This record will help prevent future halts.

In order to provide this information, the operator must:

- Make sure that a current set of load maps is stored in a safe place, preferably with the system logbook.
- Spool out LOGREC at regular intervals and keep the spooled copies on file.
- Take tape dumps when halts occur, if requested to do so by the analyst. (Table 20-1 identifies those halts for which tape dumps are most likely to be useful.)

Load maps are named RING0.MAP and RING3.MAP. (Earlier systems had one map, named M_PRMO.) Load maps are stored in UFD PRIRUN. Since the load maps change whenever additions or updates of software are made to PRIMOS, the operator should be sure to spool new copies of the maps whenever the system is updated.

HANDLING HALTS UNDER PRIMOS

Halts that occur when the system is running under PRIMOS are handled in four steps, as follows:

1. Determine the segment number and address at which the halt occurred.
2. Look up the address on your spooled copy of the PRIMOS load map to determine the name of the halt location.
3. Check Table 20-1 to find out which recovery procedure is appropriate for halts occurring at this location.
4. Take the appropriate steps for recovery, as detailed in Table 20-2.

These steps are described in more detail below.

Caution

Never press the MASTER CLEAR switch until you have determined the halt location. Once this switch has been pressed, the halt location is unobtainable. Without the halt location, the cause of the halt cannot be determined.

Step 1: Determine the Segment Number and Address

On the Prime 400 family systems, a distinction is made between hardware-related faults, called checks, and software-related faults.

Checks: When PRIMOS halts due to a check, an octal address is displayed in the control panel lights. Checks currently defined are as follows:

<u>Lights</u>	<u>Check Header Address</u>	<u>Location Name</u>
206	200	PWRFL_
277	270	MEMPA_
306	300	MCHK_
316	310	MMOD_

Write the address and location name of the halt, together with the date and time of the halt, into your system logbook. (See the System Architecture Reference Guide for a complete discussion of checks.)

Software-related Halts: For software-related halts, take the following steps:

First find the halt address:

1. Turn the rotary switch to STOP/STEP.
2. Set the ADDRESS/DATA switch to ADDRESS. Enter the address displayed in the lights in the logbook.

Then find the segment number of the halt:

1. Turn the rotary switch to FETCH Y.
2. Set the ADDRESS/DATA switch to ADDRESS.
3. Push the DATA CLEAR switch.
4. Enter '14 in the lights.
5. Set sense switches 1 and 4 to the up position.
6. Set the ADDRESS/DATA switch to DATA.
7. Push START. Enter the segment number displayed in the lights into the logbook.

Step 2: Determine the Location

If the halt was a software halt, look up the address of the halt in a spooled copy of your current PRIMOS load map. Either the address you have or the address immediately preceding it in the listing should be a recognized halt location. (The names of recognized halt locations end in underscores; for example, PWRFL_.) Write the name of the halt location in the system logbook next to the halt address.

An example of such a procedure follows:

1. The CPU halts at segment 4, location 306.
2. Find the segment number (0004) on the load map. Your load map will be similar to the one shown here. Note that the segment number appears in the second column.

WARMCN	0004	000237	OTHER
PFFLAG	0004	000241	OTHER
PFAILS	0004	000242	OTHER
MEMPA_	0004	000276	OTHER
MCHK_	0004	000305	OTHER
MMOD_	0004	000315	OTHER
MEMH2_	0004	000317	OTHER
MT2INT	0004	000321	OTHER
CHKEND	0004	000321	OTHER
MTINT	0004	000323	OTHER
MGINT	0004	000325	OTHER
MG2INT	0004	000327	OTHER
INTEN2	0004	000452	OTHER
SECOM	0004	000500	COMMON
CLKSEM	0004	000500	OTHER
SLCSEM	0004	000502	OTHER
AMLSEM	0004	000504	OTHER
MPCSEM	0004	000506	OTHER
MP2SEM	0004	000510	OTHER

3. Find the word number on the map. Word numbers are found in the third column. In this example, 000305 is the largest number on the listing ≤ 306 . Therefore, it is the correct number for this halt.
4. The name of the halt location (shown in the first column) is MCHK_, a machine check.

How to Proceed Without a Map: If you cannot find a load map, and hence cannot look up the halt location, do a tape dump (action code D) and then try a warm start (action code W). If the warm start fails, try a cold start (action code C). As soon as the system is started, look for RING0.MAP in the UFD PRIRUN. Look up the address of the halt, or the address preceding it, on this map and record it in the logbook. Then spool a copy of the map immediately and put it in the front of the logbook (or some other safe place) for easy reference.

Step 3: Find the Appropriate Recovery Procedure

Refer to Table 20-1 for the action code that matches each recognized halt location.

If your halt occurred at an address that is not a recognized halt location, use the action codes for "All others" shown at the bottom of Table 20-1.

Table 20-1
Action Codes for Halts

Halt Location	Reason for Halt	Action Code(s)
AMLC1_	Bad AMLC interrupt	D, W
BDMEM_	Bad memory during cold start	M
BOOT0_	Halt after SHUTDN ALL	D, C
MCHK_	Machine check	R, D, W
MEMH2_	Halt after automatic mapout of bad page	R, W
MEMPA_	Uncorrected memory parity error	X, M
MMOD_	Missing memory module	D, C
All others		D, C

Step 4: Take the Appropriate Steps for Recovery

Table 20-2 details the procedures to follow for each action code. Follow the instructions given in this table, and record the results in your system logbook.

Table 20-2
Recovery Procedures

Code	Action
C	<p><u>Cold Start</u></p> <p>Bring the system up as if it had been shut down normally, as described in Chapter 19.</p>
D	<p><u>Crash Magnetic Tape Dump</u></p> <p>If requested by your Customer Service Representative, or if the system repeatedly halts or hangs, perform the following steps:</p> <ol style="list-style-type: none"> 1. Mount a scratch tape on drive unit 0 or 1. 2. Push the MASTER CLEAR switch. <p>Restart at address '775 if tape is on unit 0 or at address '776 if tape is on unit 1 (see Appendix D). If switch 15 or 16 is up and the restart address is '775, then the tape unit indicated by the octal setting of the switches (0-3) is used.</p> <ol style="list-style-type: none"> 3. The tape will write and then rewind. Label the tape with the date and time of the halt and, if needed, the machine identification. Record the dump in the logbook and give the tape to the person responsible for examining unusual halts.
M	<p><u>Map Out Bad Page</u></p> <ol style="list-style-type: none"> 1. Turn rotary switch to RUN. 2. Push START button. <p>When this action is taken following a memory parity error, PRIMOS maps out the bad page; that is, it records the location as being bad and doesn't use that page of memory in the future. PRIMOS then continues the cold start.</p>
	<p><u>Note</u></p> <p>As of Rev. 19.2, PRIMOS will no longer halt the system when it discovers a memory parity error during system coldstart. It will automatically map out the bad page instead.</p>

19.2

Table 20-2 (continued)
Recovery Procedures

Code	Action
R	<p><u>Record Register Settings</u></p> <p>Record the contents of registers '34, '35, and '36 in the logbook. (See Appendix D.) For each register, perform the following steps:</p> <ol style="list-style-type: none"> 1. Turn the rotary switch to FETCH Y. 2. Push the DATA CLEAR switch. 3. Enter the register ('34, '35, or '36) in the lights. 4. Place sense switches 1, 2, and 4 in up position. 5. Set ADDRESS/DATA switch to DATA. 6. Push START. The number in the lights is the high half of the 32-bit register. To display the low half, put sense switch 4 down and push START again. The contents of the registers should be recorded in the logbook.
W	<p><u>Warm Start</u></p> <ol style="list-style-type: none"> 1. Turn the rotary switch to STOP/STEP. 2. Press the MASTER CLEAR switch. 3. Turn the rotary switch to RUN. 4. Press the START switch twice. <p>The system should restart and type WARM START at all terminals except the supervisor terminal. For example:</p> <p>SYSTEM WARM STARTING, PLEASE WAIT</p> <p>***** WARM START *****</p>

Table 20-2 (continued)
Recovery Procedures

Code	Action												
<div>Note</div> <p>A warm start restarts all input/output controllers before restarting PRIMOS. Thus, a warm start may run for 20 seconds or more before the WARM START message appears at the user terminals. It will be slightly longer before a message appears at the supervisor terminal. Do not assume a warm start has failed without waiting 20 seconds and checking the user terminals for the WARM START message.</p>													
X	<div>Uncorrected Memory Parity Error</div> <div><div>1. Determine where error occurred and record results in logbook.</div><div>Access locations 0, 1, and 2 (with no sense switches set) to obtain the contents of the X-, A-, and B-registers. These are 16-bit registers containing the following information:</div><table><thead><tr><th>Location</th><th>Register</th><th>Contents</th></tr></thead><tbody><tr><td>0</td><td>X</td><td>user getting parity error</td></tr><tr><td>1</td><td>A</td><td>page number</td></tr><tr><td>2</td><td>B</td><td>offset within page</td></tr></tbody></table><div><div>2. If user number (from register X) is 1 (supervisor), then a cold start must be done (action code C).</div><div>3. If user number is not 1, have PRIMOS map out the bad page by turning the rotary switch to RUN and pushing the START button (as shown under action code M). This prevents that page of memory from being used again.</div><div>4. When it has mapped out the bad page, the system will halt at MEMH2_. It must then be warm started (action code W).</div></div></div>	Location	Register	Contents	0	X	user getting parity error	1	A	page number	2	B	offset within page
Location	Register	Contents											
0	X	user getting parity error											
1	A	page number											
2	B	offset within page											

HANDLING HALTS UNDER PRIMOS II

PRIMOS II may be halted by the operator to abort a long listing or to recover from a bad startup. Such a halt could also be caused by a hardware condition or equipment failure. If the fault is in the hardware, the operator should not attempt to restart the system until the hardware problem has been corrected.

To restart from a halt while running PRIMOS II, perform the following steps:

1. Turn the rotary switch to STOP/STEP.
2. Press the MASTER CLEAR switch.
3. Set '170000 in the sense switches (sense switches 1, 2, 3, and 4 in UP position).
4. Turn the rotary switch to LOAD.
5. Press the START switch.
6. Reset the sense switches to 0.

PRIMOS II will restart and then respond:

OK:

Section 1: Introduction

The purpose of this document is to provide a comprehensive overview of the project's objectives, scope, and timeline. This document is intended for the project team and stakeholders, and it serves as a reference for the project's progress and status.

The project is a multi-phase initiative that aims to improve the efficiency and effectiveness of the organization's operations. The project is divided into three main phases: planning, execution, and evaluation.

The first phase, planning, involves identifying the project's goals, objectives, and scope. This phase also includes the development of a project plan and the assignment of roles and responsibilities.

The second phase, execution, involves the implementation of the project plan. This phase includes the collection of data, the analysis of results, and the implementation of changes.

The third phase, evaluation, involves the assessment of the project's outcomes. This phase includes the comparison of actual results with the project's goals and objectives, and the identification of areas for improvement.

The project is expected to be completed by the end of the year. The project team is committed to ensuring that the project is completed on time and within budget.

The project team is composed of members from various departments, including the finance, operations, and marketing departments.

The project team is currently in the planning phase of the project. The project team is working on the development of a project plan and the assignment of roles and responsibilities.

The project team is committed to ensuring that the project is completed on time and within budget.

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21

Prime 400 Shutdown

INTRODUCTION

Shutting down a Prime 350, 400, or 500 involves simply shutting down the operating system (PRIMOS or PRIMOS II) and then powering down the system in the proper order.

This chapter discusses the following procedures:

- Shutting down the operating system
- Removing system power

SHUTTING DOWN THE OPERATING SYSTEM

The procedure for shutting down the operating system depends upon whether PRIMOS or PRIMOS II is running.

Shutting Down PRIMOS

Before shutting down PRIMOS, you should warn the user community of the impending shutdown. For information on how to do this, see Chapter 22.

To shut down PRIMOS, type the following:

```
OK, SHUTDN ALL  
REALLY? YES  
WAIT,  
PRIMOS NOT IN OPERATION
```

When the "REALLY?" prompt is given, any answer except "YES" aborts the shutdown. If you answer "YES", system power should then be removed, as described in Removing System Power.

Shutting Down PRIMOS II

To shut down PRIMOS II, enter the following command:

```
OK: SHUTDN  
OK:
```

Unlike PRIMOS, PRIMOS II will not halt the CPU as a result of this command. However, it is in effect shut down. If you wish to power down the system, do so as described below. If you wish to stop the CPU without shutting off the system power, set the rotary knob to the STOP/STEP position and press the MASTER CLEAR button on the system status panel.

REMOVING SYSTEM POWER

Shut down equipment in the reverse order of system startup:

- Turn off peripheral devices.
- Turn off dataphone sets.
- Turn off all magnetic tape drives.
- Turn off disk drives; wait until all disks have stopped.
- Turn off the CPU.

PART VII

Software Startup Procedures

WANT TO

Get your share of the business

22

System Startup and Shutdown

INTRODUCTION

After the initial system boot sequence, the procedures involved in starting up and shutting down the system are essentially the same for all Prime machines. This chapter describes these common procedures. In addition, this chapter discusses the two system configuration files used during startup. These files are `CMDNCO>C_PRMO` and `CMDNCO>CONFIG`.

Note

As of Revision 19.0, PRIMOS will use the file `CMDNCO>PRIMOS.COMI` as its system configuration file. If this file does not exist, it will use the file `CMDNCO>C_PRMO` instead. This change is designed to promote use of standard suffixes for file names.

Both this volume and Volume II of this book refer to the file as `CMDNCO>C_PRMO` or just `C_PRMO`. If your system has a file named `CMDNCO>PRIMOS.COMI`, then the `CMDNCO>C_PRMO` file is not used during system startup, and references made to `C_PRMO` should be treated as references to `PRIMOS.COMI` instead.

SYSTEM STARTUP

Once the system is powered up, it may be booted. On the Prime 2250 and 9950, turning on the system power automatically initiates the system boot sequence. On all Prime machines with a Virtual Control Panel (VCP), this sequence may also be initiated with the commands:

```
SYSCLR
BOOT 14114
```

On the Prime 9950, the following command can be used:

```
BOOTP
```

In all of these cases, the boot sequence performs all of the actions necessary to start up PRIMOS. At certain times, the system may already be running PRIMOS II. To start up PRIMOS while running from PRIMOS II, issue the following PRIMOS II command:

```
PRIMOS
```

This will start up PRIMOS from the default PRIMOS directory on your system. The name of this default directory will be printed in the form of an ATTACH command, with the ATTACH command abbreviated to A. There are other ways of starting up PRIMOS. For more information on these alternate ways, see the discussion of the PRIMOS command in Volume II of this book.

Once PRIMOS begins running, it reads the system configuration files and performs its initialization sequence. After system initialization is completed, additional startup commands are given by the operator to allow users to log in. The system configuration files and additional startup commands are discussed below. In addition, messages sent by PRIMOS and its subsystems are discussed, as is the use of a video display unit (VDU) as a supervisor terminal.

System Configuration Files

Two files usually residing in the directory CMDNC0, the CONFIG and C_PRMO (or PRIMOS.COMI) files, are of particular importance at system startup time. These files are created by the System Administrator; they are appropriately protected and should never be modified without the prior approval of the Administrator.

The CONFIG file holds the data for system configuration. C_PRMO is a command file that invokes CONFIG, sets system parameters, and performs a number of other operations necessary to configure the system.

After the PRIMOS command is given, the operating system attaches to UFD CMDNC0 and looks for the file PRIMOS.COMI. If it does not find this file, it looks for the file C_PRMO.

Note

It is strongly recommended that the CONFIG file permanently reside in the directory CMDNC0. The CONFIG file may have any legal name. In the example below, it is named "CONFIG.SYS".

If PRIMOS.COMI or C_PRMO exists, the system responds with:

```
CONFIG -DATA CONFIG.SYS
PRIMOS 19.2
```

nnnnK BYTES MEMORY IN USE

The PRIMOS.COMI or C_PRMO file is started. The first command of this file invokes the CONFIG file.

If neither PRIMOS.COMI or C_PRMO exist, the system will print the message:

PLEASE ENTER CONFIG

Commands must then be entered from the supervisor terminal. If commands are to be entered manually, specific instructions regarding system configuration must be obtained from the System Administrator.

Whether commands originate at the supervisor terminal or are stored in a C_PRMO file, the first command must be the CONFIG command. (Details on the CONFIG command can be found in the System Administrator's Guide).

An Example of a CONFIG File: The first action C_PRMO takes is to invoke the CONFIG file. This section is an example of a CONFIG file. The symbol "/*" indicates an explanatory comment that appears in the file. All numbers are in octal.

```
/* CONFIG DATA FOR SYSTEM SYB 19.2 04/16/83
ASRATE 1010          /* Set baud rate of supervisor terminal
TYP0UT YES           /* Print the following CONFIG commands at
                      /* supervisor terminal
AMLTIM 2 3410 1130   /* Set variable event timers
NTUSR 76             /* Set number of terminal users
TYP0UT NO            /* Do not print the following CONFIG
                      /* commands at supervisor terminal
COMDEV 4463          /* Specify command device
PAGDEV 11060          /* Specify paging device
MAXPAG 10000          /* Set number of pages of physical memory to
                      /* validate at system startup
NLBUF 200            /* Use 128 locate buffers
NAMLC 2              /* Set number of assignable AMLC lines
NPUSR 25             /* Set number of phantom users
NSLUSR 20            /* Set number of slave users
```

| 19.1


```

NRUSR 25          /* Set number of remote users
NUSEG 360         /* Set number of virtual memory segments
                  /* available
SMLC ON          /* Enable SMLC
NET ON           /* Specify that network is to be configured
LOGREC 0         /* Turn event logger on
LOGLOG YES       /* Enable LOGIN without LOGOUT
LOUTQM 74        /* Set forced logout interval
DISLOG NO        /* Set disconnect logout option
LOGMSG NO        /* Suppress printing of LOGIN/LOGOUT
                  /* messages at supervisor terminal

/* BUFFER SIZES FOR LINES AT 9600 BAUD ARE NOW:
/* INPUT BUFFER = 256 CHARS
/* OUTPUT BUFFER = 1024 CHARS
/* DMQ BUFFER = 128 CHARS
AMLBUF 3 0 1000 200 /* Set terminal I/O buffers
AMLBUF 4 0 1000 200 /* Set terminal I/O buffers
AMLBUF 5 0 1000 200 /* Set terminal I/O buffers
AMLBUF 6 0 1000 200 /* Set terminal I/O buffers
AMLBUF 7 0 1000 200 /* Set terminal I/O buffers
AMLBUF 10 0 1000 200 /* Set terminal I/O buffers
AMLBUF 11 0 1000 200 /* Set terminal I/O buffers
AMLBUF 12 0 1000 200 /* Set terminal I/O buffers
AMLBUF 13 0 1000 200 /* Set terminal I/O buffers
AMLBUF 14 0 1000 200 /* Set terminal I/O buffers
AMLBUF 15 0 1000 200 /* Set terminal I/O buffers
AMLBUF 16 1500 1000 200 /* Set terminal I/O buffers
                        /* (QA/WP TERMINAL)
AMLBUF 17 0 1000 200 /* Set terminal I/O buffers
AMLBUF 20 0 1000 200 /* Set terminal I/O buffers
AMLBUF 21 0 1000 200 /* Set terminal I/O buffers
AMLBUF 22 0 1000 200 /* Set terminal I/O buffers
AMLBUF 23 0 1000 200 /* Set terminal I/O buffers
AMLBUF 24 0 1000 200 /* Set terminal I/O buffers
GO                    /* End CONFIG data file

```

The final line of the CONFIG file is always GO. This causes an automatic return to the command file C_PRMO.

An Example of a C_PRMO file: The command file C_PRMO is built by the System Administrator. An example of C_PRMO is given below.

In some installations the operator may be called upon to modify the C_PRMO file. If you are asked to do this, check to make sure that PRIMOS.COMI does not exist. If it does exist, then modify the PRIMOS.COMI file instead. For specific information regarding system configuration, see the System Administrator's Guide.

C_PRMO always begins with the command line

```
CONFIG -DATA filename
```

where "filename" is the name of the data configuration file.

The succeeding command lines will start up devices, configure terminal lines, share memory segments, and perform other actions necessary to make the system functional. This is done both by invoking individual commands (command lines beginning with ADDISK and other PRIMOS operator commands) and by invoking other command input files (command lines beginning with COMINPUT).

Following is an example of C_PRMO:

```

CONFIG -DATA CONFIG.SYS /* Invoke CONFIG file "CONFIG"
ADDISK 460 32060 71061 /* Start up local devices
COMOUTPUT -NTTY /* Turn off terminal output
AMLC TTY 0 2213 /* Configure AMLC line
/* (300 baud telephone line)
AMLC TTY 1 2213 /* Configure AMLC line
/* (300 baud telephone line)
AMLC TTY 2 2213 /* Configure AMLC line
/* (300 baud telephone line)
AMLC TTY 3 2413 /* Configure AMLC line
AMLC TTY 4 2413 /* Configure AMLC line
AMLC TTY 5 2413 /* Configure AMLC line
AMLC TTY 6 2413 /* Configure AMLC line
AMLC TTY 7 2413 /* Configure AMLC line
AMLC TTY 10 2413 /* Configure AMLC line
AMLC TTY 11 2413 /* Configure AMLC line
AMLC TTY 12 2413 /* Configure AMLC line
AMLC TTY 13 2413 /* Configure AMLC line
AMLC TTY 14 2413 /* Configure AMLC line
AMLC TTY 15 2413 /* Configure AMLC line
AMLC TTY 16 2413 /* Configure AMLC line
AMLC TTY 17 2413 /* Configure AMLC line
AMLC TTY 20 2413 /* Configure AMLC line
AMLC TTY 21 2413 /* Configure AMLC line
AMLC TTY 22 2413 /* Configure AMLC line
AMLC TTY 23 2413 /* Configure AMLC line
OPR 1 /* Enable SHARE command (requires OPR 1)
SHARE SYSTEM>ED2000 2000 /* SHARE the editor (ED)
SHARE SYSTEM>S2050 2050 700 /* Share Fortran library
R SYSTEM>S4000 1/1 /* Package number 1.
SHARE 2050 /* Prevent users from writing this segment
SHARE SYSTEM>MP2122 2122 700 /* Share MIDASPLUS library.
SHARE SYSTEM>MP2123 2123 700
SHARE 2124 700
SHARE 2125 700
R SYSTEM>MP4000 1/2
SHARE 2122
R SYSTEM>IMIDASPLUS SYSTEM>PLUS.CONFIG
/*
SHARE SYSTEM>C2014A 2014 700 /* Share COBOL library.
SHARE SYSTEM>C2014B 2014 700
R SYSTEM>C4000 1/3
SHARE 2014
SHARE SYSTEM>F2021A 2021 700 /* Share FORMS library.
SHARE SYSTEM>F2021B 2021 700

```



```

19.2 | R SYSTEM>F4000 1/4
      | SHARE 2021
      | SHARE SYSTEM>SP2121 2121 /* Share SPL library.
      | R SYSTEM>SP4000 1/10      /* Package number 10 (octal).
      | SHARE SYSTEM>S$2167 2167 /* Share SPOOL$ library (VSPOO$).
      | R SYSTEM>S$4000 1/12      /* Package number 12 (octal).
      | SHARE 2020 700
19.2 | SHARE SYSTEM>ML2222 2222 /* Share MAGLIB.
      | R SYSTEM>ML4000 1/16
      | OPR 0 /* Disable SHARE command.
      | /*
      | /* Start up the Batch and Spool subsystems.
      | /*
      | PROP PRO -START /* Start up the spooler
      | BATCH -START -RLV 2 -TS 99 /* Start up Batch
      | /*
      | /* FTS cannot be started here, as FTS.SHARE.COMI has not
      | /* yet been run.
      | /*
      | CO SYSTEM>BASICV.SHARE.COMI 7 /* Share BASICV compiler
      | CO SYSTEM>COBOL.SHARE.COMI 7 /* Share COBOL compiler and
      | /* library
      | CO SYSTEM>DBG.SHARE.COMI 7 /* Share debugger
      | CO SYSTEM>DBMS.SHARE.COMI 7 /* Share DBMS
      | CO SYSTEM>EMACS.SHARE.COMI 7 /* Share EMACS
      | CO SYSTEM>FED.SHARE.COMI 7 /* Share FED
      | CO SYSTEM>FORMS.SHARE.COMI 7 /* Share FORMS
      | CO SYSTEM>FTS.SHARE.COMI 7 /* Share FTS
      | CO SYSTEM>F77.SHARE.COMI 7 /* Share F77 compiler
      | CO SYSTEM>MIDASPLUS.SHARE.COMI 7 /* Share MIDASPLUS library
      | CO SYSTEM>PASCAL.SHARE.COMI 7 /* Share PASCAL
      | CO SYSTEM>PL1G.SHARE.COMI 7 /* Share PL1G compiler
      | CLOSE 7
      | COMOUTPUT -TTY /* Turn terminal output back on
      | A CMDNCO
      | CLOSE 7 /* Close file unit 7
      | OPR 0 /* Disable SHARE
      | ADDISK SYSSYS COCOA VANIL -ON SYS /* Make remote disks on
      | ADDISK SYSSYA OSPRY IUDGR1 -ON SYA /* SYA SYD SYE
      | ADDISK SYSSYM OSCRL BBRD -ON SYM /* SYG SYI
      | ADDISK SYSSYD TRNS MRGFY -ON SYD /* SYM SYO SYP SYQ
      | ADDISK SYSSYE IUDGR1 IUDGR2 FTING -ON SYE /* SYS SY.CAD
      | ADDISK SYSSYG MOE CURLY LARRY -ON SYG /* RES.X1 RES.X2
      | ADDISK SYSSYP -ON SYP /* available to users
      | ADDISK SYSSYQ -ON SYQ /* of local system
      | ADDISK SPOOLA EUA LAPIS LJFHJ -ON SYA /* " "
      | ADDISK QW1 QW2 QW3 -ON SYA /* " "
      | ADDISK SYSSYI QW5 QW7 -ON SYI /* " "
      | ADDISK SYSSYO MYHRR FRONSE -ON SYO /* " "
      | ADDISK SYSCAD -ON SY.CAD /* " "
      | ADDISK RESRCH -ON RES.X1 /* " "
      | ADDISK KYHJKJ -ON RES.X2 /* " "
      | FTOP -START_MNGR /* Start FTS manager
      | FTOP -START_SRVR FTP /* Start FTS server

```



```
COMOUTPUT -END          /* Close this COMO file
/* TYPE MAXUSR TO ALLOW USERS TO LOG IN
COMINPUT -END          /* End command file
```

19.2

COMINPUT files within C_PRMO: Several COMINPUT files will be invoked when a program such as the above example of C_PRMO is run. Such files are built by the System Administrator.

The COMINPUT files invoked by the above example are located in the directory SYSTEM. Two examples of such files are:

```
/* COBOL.SHARE.COMI, COBOL, JPC-RHB, 04/01/80
/* shares COBOL compiler and library
/* Copyright (C) 1980, Prime Computer, Inc., Wellesley, MA 02181
/*
OPR 1
SHARE SYSTEM>C2014A 2014 700
SHARE SYSTEM>C2014B 2014 700
R SYSTEM>C4000 1/3
SHARE SYSTEM>CO2016 2016
SHARE 2014
OPR 0
CO -CONTINUE 6
CO -END
```

```
/* MIDAS.SHARE.COMI, MIDAS, LSH, 06/10/81
/* SHARE & INITIALIZE MIDAS FROM THE SUPERVISOR TERMINAL
/* Copyright (c) 1980, Prime Computer, Inc., Natick, MA 01760
/*
/*
OPR 1
SHARE SYSTEM>K2014A 2014
SHARE SYSTEM>K2014B 2014
R SYSTEM>K4000 1/2
SHARE 2020 700
OPR 0
R SYSTEM>IMIDAS
/*
CO -CONTINUE 6
CO -END
```

Additional System Startup Commands

To make the system fully operational, additional actions must be taken after C_PRMO is invoked. These actions are largely defined by what is (or is not) contained in the files CONFIG and C_PRMO. Generally, an operator may expect to perform the following operations:

- Enter the date and time if the system does not have a built-in clock.

19.2

- Enter the MAXUSR command to enable user login.
- Add to the system any remote disks not started during system configuration if the system is on a network.

Other commands may be given at this time, depending upon your system's startup procedure. The System Administrator should provide you with guidelines as to exactly what additional actions should be taken. Some possibilities are indicated below.

Setting the Time and Date: On some systems, the date and time are set automatically, using a built-in clock. On many systems, the SETIME command is performed as a part of the C_PRMO command file; the command file pauses, asks the operator to issue a SETIME command, and then to type COMINPUT -CONTINUE. Thus, the time and date are set during the running of C_PRMO. If this is the case, a prompt will appear telling you to enter appropriate time and date information at the supervisor terminal.

During system startup, the SETIME command must be entered at the supervisor terminal. To set the system date and time, issue the command:

```
SETIME -mmddyy -hhmm
```

where mmddyy are digits that represent the month, day, and year and hhmm are digits that represent the time in hours and minutes.

19.2

For example:

```
OK, SETIME -110282 -1530
```

Then, if the SETIME command is issued as part of the C_PRMO file, issue the command:

```
COMINPUT -CONTINUE
```

This will cause the system startup to continue. The system startup process has completed when the final command in the C_PRMO file is read by PRIMOS. This command is usually:

```
OK, COMINPUT -END
```

or:

```
OK, CO -E
```

When the startup file has been read and the system date and time have been set, the system is ready for users to log in.

Enabling User Login: To allow users to log in, issue the command:

MAXUSR

The system responds by displaying the following message at all of the user terminals connected to the system:

Login please.
OK,

Users may then log in.

To prevent users from logging in, do not issue the MAXUSR command. For information on allowing only a certain number of users to log in, see the description of the MAXUSR command in Volume II of this book.

Adding Remote Disks to the System: Remote partitions not started by C_PRMO may be added to the system with the ADDISK command:

ADDISK diskname-1 [diskname-2...diskname-9] -ON nodename

For example, to add the disks PAMPA and STEPPE located on remote system FIELDS, enter:

OK, ADDISK PAMPA STEPPE -ON FIELDS

These disks are now connected to the system.

COMINPUT or CPL files may also be invoked to add remote disks. For example, to run the command input file REMOTE in UFD SYSTEM, enter:

OK, COMINPUT SYSTEM>REMOTE

The previously written command file would then take over, adding specified disks.

For more information on working with remote disks, see Volume II of this book.

Starting the Batch Monitor: In the above example of the C_PRMO file, the Batch monitor is started by the BATCH -START command in C_PRMO. The monitor, however, will not actually start running until the system time and date have been set with the SETIME command. For information on the Batch subsystem, see Volume II of this book.

Starting the Spooler Subsystem: In the above example of the C_PRMO file, the spooler phantom for printer PR0 is started by the command PROP PR0 -START in C_PRMO. The spooler begins operation immediately. For information on the spool subsystem, see Volume II of this book.

Starting the File Transfer Service (FTS): In the above example of the C_PRMO file, the FTS manager and server are started with the commands FTOP -START_MNGR and FTOP -START_SRVR FTP, respectively. For information on the File Transfer Service, see Volume II of this book.

Additional Actions: Some additional tasks you may have to undertake at the time of system startup are:

- Issuing the command CHAP, to grant special priorities and time slices to particular operations.
- Invoking MAXUSR, if special limits must be placed on the number of users the system can accommodate.
- Starting special phantoms if needed.

Operator commands are described in detail in Volume II of this book.

PRIMOS Messages at System Startup

During the startup procedure, PRIMOS prints messages at the supervisor terminal when certain requested operations have been performed. (These messages do not occur immediately after the requested operation. They may appear up to five or ten minutes afterwards.)

The File Access Manager: If your system is running only FAM II, there will be no FAM messages. Messages that will appear on systems running FAM I are listed in Volume II of this book.

The Batch Subsystem: This message will be transmitted if the Batch subsystem has been started:

Monitor started up.

This will soon be followed by the message:

Monitor in operation.

The File Transfer Service: When the command FTOP -START_SRVR FTP is given, the system responds with the message:

[FTOP rev 1.0]

Server ftp phantomd, - user number is xx.

When the server has been successfully started up, the system responds with the message:

```
*** FTP (user xx on sysname) at hh:mm
hh.mm.ss: FTS server - FTP started up on day, date, year
```

When the command FTOP -START_MNGR is given, the system responds with the message:

```
[FTOP rev 1.0]
Manager YTSMAN phantomed, - user number is xx.
```

When the FTS manager has been successfully started up, the system responds with the message:

```
*** YTSMAN (user xx on sysname) at hh:mm
[YTSMAN rev 1.0] started.
```

Other Messages: Certain other messages may appear at system startup. Your system's message output at startup time will reflect changes made by the System Administrator to the C_PRMO command file. If messages with which you are unfamiliar appear, note them in the system logbook and ask the System Administrator about their meaning.

If Your Supervisor Terminal is a Video Display Unit (VDU)

On systems using a video display unit (VDU) as a supervisor terminal, a COMOUTPUT (or COMO) file is used to store system messages. Commands that open this file should be placed in the C_PRMO file, immediately after the CONFIG command. The first three lines of such a C_PRMO file would read as follows:

```
CONFIG -DATA CONFIG          /* Specify CONFIG file
COMOUTPUT SYSTEM.COMO -CONTINUE -TTY /* Continue COMO to file
STATUS SYSTEM                /* Print system information
```

Here, SYSTEM.COMO is the name of this COMOUTPUT file.

Note

If the disk partition on which CMDNC0 resides is an ACL partition, user SYSTEM must be given at least ALURW access to CMDNC0. Users must have LUR rights.

It is the responsibility of the System Administrator to maintain and edit the command output file so that it does not become so large as to be unmanageable. If you notice that the COMOUTPUT file is becoming too large, notify your System Administrator.

The system COMOUTPUT file is supported by a 384-character buffer provided to store all messages for the supervisor terminal user (user 1). All messages sent to the supervisor terminal by other processes are directed to this buffer.

If messages come in faster than they can be taken from the buffer, later messages will be lost. (Multiple disk error messages could cause such a condition to occur.) PRIMOS indicates this with the message:

User 1 message buffer overflowed. nn characters lost.

SYSTEM SHUTDOWN

The procedure for shutting down the system is discussed in detail below. Most often, the system is shut down to perform backups and other related maintenance activities. For information on these procedures, see Volume II of this book.

Controlling Logins and Logouts

In certain circumstances, it may be necessary for the operator to limit users' access to the system.

Limiting Logins: The maximum number of users allowed to be logged in to the system can be decreased from the configured value by using the MAXUSR command with the following format:

MAXUSR n

Here, n is an octal integer that is less than the configured number of users. This number specifies the maximum allowed number of logged in users. If the number of users logged in exceeds n, no users will be logged out, but no new users may log in and no phantoms may be started. This feature is useful when:

- Modifications are to be made to systemwide files (such as shared libraries) at a cold start. Before setting the system time and date, set MAXUSR to 1 or 2, preventing users from logging in until you finish making the modifications, then reset MAXUSR. Setting MAXUSR to allow one extra user allows the operator to log in at a nearby user terminal, to expedite activities to be performed before users are allowed to log in.
- The system is to be shut down. Set MAXUSR to 0 to prevent any new logins just prior to shutdown. (See also the section on forcing logouts, next.)

Forcing Logouts: From the supervisor terminal, the operator may forcibly log out any user by the LOGOUT command. The connection of a process to a terminal over the network is forcibly broken by the LOGOUT command. Individual processes are logged out using the LOGOUT command as follows:

LOGOUT -userno

Here, userno is the decimal number of the terminal or phantom being disconnected. If the user is a local terminal using a remote process, the terminal is reconnected to its local process. If the user is a remote terminal using a local process, the process is logged out and returned to the pool of free remote login processes.

Note that logging out a user does not necessarily guarantee that the user will be immediately logged out. In fact, the system will allow any logged out user up to two minutes elapsed time to complete any sensitive processing. The user is rarely actually aware that this grace period has been granted; the user's program may use the grace period to save an edit session, return a database to a consistent state, and so on.

All remote, local, and phantom users can be forcibly logged out by the LOGOUT ALL command. The only exceptions are user 1 (the supervisor terminal) and NETMAN, which are never affected by the LOGOUT command. (FAM I is not affected by LOGOUT ALL, but may be logged out by specifying the FAM user by usernumber in the LOGOUT command.)

Use of LOGOUT ALL causes an implicit MAXUSR 0 to be performed. Therefore, no users may log in until MAXUSR is reset. LOGOUT ALL can be issued just prior to a SHUTDOWN ALL command to allow a more orderly shutdown of PRIMOS. However, make certain that all users (except user 1 and NETMAN) have in fact been logged out before issuing the SHUTDOWN ALL command. Two or three minutes should be sufficient.

Notes

Before logging out or disconnecting users, the operator, as a matter of courtesy, should use MESSAGE to notify the users in advance, allowing them to reach a reasonable stopping place in their work.

The operator can make sure that all users and phantoms are logged out by issuing the command STATUS USERS.

User 1 (the supervisor terminal) and NETMAN are not affected by the LOGOUT command.

Do not log out the FIS manager or FIS servers; use the FTOP command instead.

System Shutdown Procedure

The shutdown procedure is as follows:

1. Send shutdown messages to inform local users and operators of any remote systems that a system shutdown is anticipated. Give users as much advance notice as is possible.

Local users are contacted with MESSAGE ALL -NOW. Remote systems are contacted with the command format: MESSAGE -l -NOW -ON nodename. For example, to contact all users on system SYB, and to contact the operators of systems SYH, SYD, and SYE, the command format would be:

```
OK, MESSAGE ALL -NOW
SYSTEM GOING DOWN IN 5 MINS. PLEASE LOGOUT
OK, MESSAGE -l -NOW -ON SYH
SYB GOING DOWN IN 5 MINS.
OK, MESSAGE -l -NOW -ON SYD
SYB GOING DOWN IN 5 MINS.
OK, MESSAGE -l -NOW -ON SYE
SYB GOING DOWN IN 5 MINS.
OK,
```

2. Prevent new users from logging into the system with the MAXUSR command. Setting MAXUSR to zero prevents additional users from logging in, but does not interfere with users currently on the system.

This also prevents the Batch monitor from starting up new Batch jobs. Batch jobs that are currently running will continue to run, until they are forcibly logged out.

```
OK, MAXUSR 0
```

3. Prevent subsystems from starting up new jobs. This is done by telling the spooler phantoms to shut down after finishing their current jobs, and telling FTS servers to shut down after finishing their current transfers.

Failure to give the spooler phantoms and the FTS servers sufficient time to log themselves out before being force-logged out may result in database problems.

```
OK, PROP PRO -STOP
[PROP rev 19.0]
```

Wait... Acknowledged.

OK,

```
*** SYSTEM (user nnn on sysname) at hh:mm
*SPOOL* PRO          — STOPPING
```

Phantom nn: Normal logout at hh:mm

Time used: xxh xxm connect, xxm xxs CPU, xxm xxs I/O

FTOP -STOP_SRVR FTP
[FTOP rev 1.0]
Server notified to stop.

OK,
*** FTP (user nnn on sysname) at hh:mm
hh.mm.ss: FIS Server - FTP closed down on day, date, year

*** FTP (user nnn on sysname) at hh:mm
hh.mm.ss: Server shutdown by operator.

Phantom nn: Normal logout at hh:mm
Time used: xxh xxm connect, xxm xxs CPU, xxm xxs I/O

4. Give all users a final warning message.

OK, MESSAGE ALL -NOW
*** SYSTEM GOING DOWN IN 1 MINUTE *** (bells)
OK,

Warning bells may be invoked by typing CONTROL-G.

Messages such as these, which are sent regularly, may be run from command input files, for convenience.

5. Stop the Batch subsystem with the BATCH -STOP command to allow the Batch monitor to log itself out gracefully.

OK, BATCH -STOP
[BATCH rev 19.0]
Stop request issued.

OK,
*** BATCH_SERVICE (user nnn on sysname) at hh:mm
Operator stop.

Phantom nn: Normal logout at hh:mm
Time used: xxh xxm connect, xxm xxs CPU, xxm xxs I/O

When the message "Operator stop." is received, the monitor has logged out and the Batch subsystem is no longer running. Batch jobs that were running at the time of the BATCH -STOP command, however, continue running.

6. Stop the FIS manager phantom. Do this after the FIS servers have been closed down. To do this, first determine YISMAN's user number with the STATUS USERS command. Then type the command line:

LOGOUT -usernum

The following message is printed:

Phantom nn: Normal logout at hh:mm
Time used: xxh xxm connect, xxm xxs CPU, xxm xxs I/O

7. Log out all users with the command line LOGOUT ALL.

OK, LOGOUT ALL
OK,

8. Use the STATUS USERS command to make sure all users have been logged out.

OK, STATUS USERS

User	No	Line	Devices
SYSTEM	1	asr	<SYSA> SMLC00 SMLC01 AL077
NETMAN	84	nsp	<SYSA>

OK,

9. When you are sure nothing is still running, shut down the system with the SHUTDN ALL command. For example:

OK, SHUTDN ALL
REALLY? YES
WAIT,
PRIMOS NOT IN OPERATION

HALTED AT 000006/003525: 003776

APPENDIXES

APPENDIX

A

Using the Virtual Control Panel

INTRODUCTION

In addition to being used during system startup and shutdown, the VCP is used during system test and maintenance activities, and during operating system development. The VCP commands needed to start up, shut down, and generally operate a system are described in the appropriate part of the book. However, there are many more commands and capabilities that are available to users that need to test the system or debug an operating system such as PRIMOS.

This appendix lists and explains all of the available VCP commands. Because there are three different versions of the VCP, some of the commands do not work on all VCPs. These restrictions will be indicated in the description for each command.

Note

On the Prime 2250 and 9950, the VCP is implemented as part of the Diagnostic Processor, and each has added functionality over the VCP of the 50 series processors.

The following commands are intended for general use by the operator:

BOOT	HELP	STOP
BOOTD	MO ST	SYSCLR
BOOTP	MO USER	SYSOUT
D register	REMPWD	TAPEDUMP
DATE	RUN	VIRY
DOS	SETIME	WARMSTART
HALT	SPINDOWN	

The following commands are intended for use only by Customer Service Representatives or by users debugging an operating system:

:O :H :B :D :A	LIGHTSC	RCP
A	LISTREV	REV
C	MO ABS	SD
D start end	MO BRIEF	SS
DIRECTORY	MO FULL	SSTEP
DISPLAY	MO MAP	STEPU
DISPLAYC	MO RFABS	STORE
F	MO RFCRS	TRACE
FETCH	MO RFH	VPSD
LIGHTS	MO RFL	

Use of any of the above commands may produce unexpected results if the actions of the commands are not fully understood.

The reader who intends to use the VCP to perform system test and maintenance activities or to debug an operating system should be familiar with the following three areas:

- Numerical representation
- Communication registers between the VCP and CPU
- Sense-switch settings

These three topics are covered in detail at the end of this appendix. After gaining some familiarity with the CP mode commands, the reader should study the text describing the above three topics, so as to become intimately familiar with the operating characteristics of the VCP.

Readers who intend to use the VCP only for standard operating procedures, such as starting up and shutting down the system, need only familiarize themselves with the commands listed at the beginning of this chapter as being for general use.

CONTROL PANEL MODE OPERATOR COMMANDS

Many of the Control Panel mode operator commands require the CPU to be stopped. A few require the CPU to be running. These commands require that the CPU be stopped:

A	F	STORE
BOOT	FETCH	SYSCLR
BOOTD	RCP	TAPE DUMP
BOOTP	RUN	TRACE
C	SPINDOWN	VIRY
D	SSTEP	VPSD
DOS	STEPU	WARMSTART

These commands require that the CPU be running:

DISPLAY
DISPLAYC
MO ST

On the Prime 9950, the Control Panel mode commands will not be executed if they are in conflict with the above requirements. On other machines, the VCP may attempt to execute them. For example, the MO ST command will place the supervisor terminal in Supervisor Terminal mode, even when the CPU is not running. To abort such commands, type <ESCAPE><ESCAPE> (two escapes) or CONTROL-P and you will be returned to Control Panel mode.

► :O, :H, :B, :D, :A

These format specifiers will set the data representation mode and optionally the address representation mode. See the chart below. They are generally used only for system test and maintenance or operating system development.

A representation mode determines how numbers are interpreted — specifically, the radix (base) of numbers. The VCP separates numeric parameters into two categories: data and address. The user may control how numerical data and addresses are interpreted when displayed or input from the user while in Control Panel mode. The legal representations set by these format specifiers are as follows:

<u>Format</u>	<u>Representation</u>
:O	octal
:H	hexadecimal
:B	binary
:D	decimal
:A	ASCII (not a legal address mode)

If two specifiers are used, the first refers to data and the second to address representation. Otherwise, only the data representation mode is changed. In this example, the data representation mode is set to binary and the address representation mode is set to hexadecimal:

```
:B :H
```

These format specifiers are also valid following the D and A commands. For example, the following command will dump, in ASCII, words '1000 through '2000:

```
D 1000 2000 :A :O
```

The default mode for both address and data representation at system power-up is octal (:O). ASCII mode (:A) is not valid for address representation. If an attempt is made to set the address representation mode to ASCII, an error message will be displayed.

Notes

The address representation mode specification on a D or A command will not take effect until after the addresses on the command line have been interpreted by the VCP. The addresses will therefore be interpreted according to the address representation mode in effect before the command is issued. Therefore, the following command sequence will display locations 45 hex (105 octal) through 47 hex (107 octal), displaying both addresses and data in octal:

```
:H :H  
D 45 47 :O :O
```

Certain numerical output performed by the VCP is not affected by the data or address representation mode in effect at the time. The message that is output when the CPU is halted will always display the halt address and its contents in octal (:O). Microverification error codes output by the Diagnostic Processor on the Prime 9950 will always be displayed in hexadecimal (:H).

All examples in this book assume that both the data and address representation modes are octal (:O) unless otherwise specified.

► A

This command is used to access the contents of main memory or the register file. It is generally used only during system test and maintenance or for operating system development.

Command Formats

The A command can be used to access a specific address in memory or a named register in the current register set. The following command format accesses main memory:

A address [modes]

The following command format accesses the register file:

A register [modes]

address is a number (in the current address representation mode) representing the word in memory to be accessed. register is a keyword identifying which register in the current register set is to be accessed. modes is an optional specification of the data and address display modes.

Accessing an Address

When address is specified, a sense-switch setting may be supplied by specifying address in the following format:

[sense/]wordno

If sense is specified, only the low-order 12 bits are used — the high-order 4 bits are set from the default sense-switch setting. (The default for these 4 bits is four zeroes.) Specifying sense also causes bits 5-16 of the default sense-switch setting to be set to sense. If sense is not specified, it defaults to the default sense-switch setting. (The default sense-switch setting is initially 0.)

The meaning of the sense-switch setting is discussed later in this appendix in the section entitled Sense-Switch Settings.

Accessing a Register

When register is specified, the current register set is always referenced. The default sense-switch setting is not affected when using the register form of the A command. Similarly, this form of the A command is not affected by the default sense-switch setting, or by any of the MD ABS/MAP or RFABS/RFCRS commands. The setting of MD RFH/RFL only affects which half of the register is modified — both halves are displayed.

To reference register sets other than the current one, the address of the register must be known, the MD RFABS command must be given, and the address form of the A command must be used as described above.

Access Command Interaction

The address of the specified word or register is displayed, followed by its contents. When accessing main memory, one 16-bit word is displayed. When accessing a register, the full 32-bit contents are displayed. However, no carriage return is displayed — the cursor remains on the line, waiting for a response.

At this point, one of the following responses may be issued:

<u>Response</u>	<u>Meaning</u>
CR (carriage return)	Access next memory location or register.
^ (uparrow)	Access previous memory location or register.
number	Modify memory location or half-register to value of <u>number</u> . (Which half of the register is <u>modified</u> , the high-order or low-order half, depends upon the last MO RFL/RFL command. The default at system power-on is MO RFL.)
/ (slash)	Exit and return to Control Panel mode. The memory location or register just displayed is not modified.

Note

If an address mode format specification is included, it will not affect the way in which address is interpreted. The address will be interpreted according to the address representation mode in effect before the A command was issued.

► **BOOT**

This command is used to boot the CPU. This command is necessary to start up PRIMOS or PRIMOS II. This command is also used to place the VCP in automatic warmstart mode, used only in conjunction with an Uninterruptable Power Supply (UPS) system.

The command format for booting the CPU is:

```
SYSCLR
BOOT number
```


It is very important to issue the SYSCLR command first, or unexpected behavior may result. This command will boot the CPU using the sense-switch setting specified by number. This setting will be interpreted by the CPU bootstrap program, which will use the value specified by number to determine what kind of boot is desired and from what device. For example, BOOT 14114 tells the CPU bootstrap program to boot PRIMOS from disk Drive 0 on controller 0. (This is the most often-used value of number.) See Appendix E for more information on determining the value of number.

The supervisor terminal will automatically be placed in supervisor terminal mode. Unless the CPU halts, any messages displayed on the supervisor terminal after the BOOT command is issued are being displayed by the CPU -- either the CPU bootstrap program, PRIMOS II, or PRIMOS.

For the Prime 9950, the recommended command is BOOTP or BOOTD, depending on whether a PRIMOS or PRIMOS II boot is desired. This is because BOOTP and BOOTD automatically perform verification of the Diagnostic Processor and CPU.

Note

The data representation mode should be set to octal (:O). This is normally the case as it is the default mode when the system is powered-up. However, if the data mode is not octal, the value of number, normally entered in octal, will be misinterpreted. The Prime 9950 provides a warning message if this situation should arise:

WRN004: Mode specifier is not set to Octal.

The BOOT command will still be executed, however. Other Prime machines provide no such warning message.

Another use of the BOOT command is to place the VCP into automatic warmstart mode. It is only used on systems that have an Uninterruptable Power Supply (UPS) system. The command format is simply this:

BOOT

After issuing this command, if the main A.C. power is interrupted, the VCP will automatically warmstart PRIMOS upon resumption of A.C. power. See Appendix F for details.

► BOOTD

(Prime 9950 only.)

This command initiates a boot sequence that starts up PRIMOS II. It is essentially the same process that occurs when the system is powered on, except that the boot sequence terminates when PRIMOS II is successfully started up. The BOOTD command initiates the following procedure:

1. Loads and verifies the CPU verification microcode.
2. Executes the CPU verification microcode to verify the CPU.
3. Loads and verifies the CPU instruction set microcode.
4. Initializes certain CPU registers.
5. Loads and verifies the Decode Net.
6. Loads the CPU bootstrap program.
7. Executes the CPU bootstrap program, starting up PRIMOS II.
8. Places the supervisor terminal in Supervisor Terminal mode.

Steps 6, 7, and 8 are equivalent to a BOOT 10114 command.

► BOOTP

(Prime 9950 only.)

This command initiates a boot sequence that starts up PRIMOS. It is essentially the same process that occurs when the system is powered on. The BOOTP command initiates the following procedure:

1. Loads and verifies the CPU verification microcode.
2. Executes the CPU verification microcode to verify the CPU.
3. Loads and verifies the CPU instruction set microcode.
4. Initializes certain CPU registers.
5. Loads and verifies the Decode Net.
6. Loads the CPU bootstrap program.
7. Executes the CPU bootstrap program, starting up PRIMOS.
8. Places the supervisor terminal in Supervisor Terminal mode.

Steps 6, 7, and 8 are equivalent to a BOOT 14114 command.

► C

This command is used to copy a range of memory from one location to another. It is generally only used during operating system development. The command format is as follows:

C start end to

The block of main memory starting at location start and ending at location end is copied to the block starting at location to. If the two blocks of memory overlap in physical memory, the copy will not be performed correctly. For example, if to falls between start and end, the data from start to to will be replicated starting at to, continuing through end up to the address specified by $\text{end} - \text{start} + \text{to}$. The original data stored between to and end will be lost.

The format of start, end, and to is as follows:

[sense/]wordno

Specifying sense for start will set the sense switches for the entire operation, as described later in this appendix in the section entitled Sense-Switch Settings. Specifying sense for end and to will not affect the copy operation — bits 5-16 of the sense-switch setting specified for start will be used. However, bits 5-16 of the default sense-switch setting will be changed to the specified value. This may affect the next VCP command.

► D

This command dumps the contents of a register or a block of main memory. It is used to display the contents of a register following an abnormal operating system halt — registers such as DSWSTAT and DSWPARITY are often examined in this situation. The D command is generally only used to display the contents of main memory during operating system development.

This command format is for dumping the contents of a register:

D register [modes]

The following command format is for dumping a block of main memory:

D start end [modes]

register is the name of a legal register for the CPU being used. The contents will be displayed as two 16-bit words, representing the complete 32-bit register. start and end are the beginning and ending addresses of the block of main memory to be displayed. Main memory is

displayed with up to eight 16-bit words per line of output. modes is an optional parameter specifying the data and address representation modes to be used.

When using the register form of the D command, the register is always assumed to be in the current register set.

The start and end form of the D command is intended only for operating system development. start and end have the following format:

[sense/]wordno

If sense is specified for start, it defines the sense-switch setting for the entire operation. Otherwise, the default sense-switch setting is used. See the section entitled Sense-Switch Settings later in this Chapter.

If sense is specified for end, it will be ignored, and the sense-switch setting specified or implied for start will be used instead. However, specifying sense for end will change bits 5-16 of the default sense-switch setting for subsequent VCP commands.

The meaning of the sense-switch setting is discussed later in this appendix in the section entitled Sense-Switch Settings.

Note

If an address mode format specification is included, it will not affect the way in which start and end are interpreted. Both start and end will be interpreted according to the address representation mode in effect before the D command was issued.

► DATE

(Prime 9950 only.)

This command displays the date and time as maintained by the battery backed-up clock on the Diagnostic Processor. For example:

18 Mar 83 19:02:56 Friday

If the date and time is not valid, it will be initialized, and the following message will be displayed:

ERR800: Diagnostic Processor time of day clock not valid.
Time and date initialized to: 01 Jan 01 01:01:00 Sunday

Note

If PRIMOS is running, it is keeping track of the date and time separately from that of the battery backed-up clock. During a coldstart or warmstart of PRIMOS, PRIMOS reads the date and time from the battery backed-up clock in the Diagnostic Processor and uses the information to set its own date and time.

However, it is possible for the two clocks to go out of synchronization, particularly if the SETIME command is used to change the date and time for either PRIMOS or the Diagnostic Processor without changing both.

If the date and time as reported by the DATE command using both PRIMOS and the Diagnostic Processor do not agree, determine the correct date and time and use the PRIMOS and Diagnostic Processor SETIME commands to update both clocks.

► DIRECTORY

(Prime 9950 only.)

This command displays the floppy disk directory contents. It is generally only used by a Customer Service Representative during initial installation of the Prime 9950, when performing microcode updates, and when performing system test and maintenance activities. The command format is as follows:

```
DIRECTORY { :0 }
              { :1 }
```

The optional argument, :0 or :1, specifies whether Drive 0 or Drive 1 is to be used. Any subsequent references to a floppy disk without specifying an explicit drive number will default to the drive number specified by this command.

If a drive number is not specified, it will default to the drive number last specified when referencing a floppy disk drive. When the system is powered-up, and when the VIRY command is issued, the default drive number is set to 0. However, if errors occur on Drive 0 during the Diagnostic Processor self-check verification process, it will switch to Drive 1, and that will become the default.

The listing of the directory contents includes a header identifying the CPU for which the floppy disk is intended, the manufacturing revision level, the part number for the floppy disk, and the floppy drive number being listed.

It then lists each file on the disk. The listing includes the filename (up to 16 characters), the file type identifier, the file verification flag, the engineering release level, the load address, the starting address (track/sector number), and the file length.

If a read error occurs during the listing, the following error message will be displayed:

ERR201: Disk read error on directory
Refer to the System Operator's Guide

At this point, switch to the other floppy disk drive and contact your Customer Service Representative for repairs to the offending drive.

► DISPLAY

This command displays the contents of a virtual memory address. It only functions when PRIMOS is running. The DISPLAY command is generally only used during operating system development. The command format is as follows:

DISPLAY address

The VCP will pass the specified address to PRIMOS via the sense switches, and PRIMOS will return the contents of the address in the lights. The VCP will then display the contents of the lights, since the lights are only an internal communication path between the VCP and the CPU.

If the specified address does not reside in main memory, the returned contents will be zero.

► DISPLAYC

This command is similar to DISPLAY, but it continuously samples the contents of the specified address. The contents are displayed whenever they change. To halt this, type CONTROL-P.

► DOS

(Prime 9950 only.)

This command is used to warmstart PRIMOS II (not PRIMOS) after it is interrupted. PRIMOS II must already be loaded. The supervisor terminal is placed in Supervisor Terminal mode. The DOS command is particularly useful after aborting a runaway output by PRIMOS II by using the VCP STOP command.

On machines that do not support the DOS command, the following command sequence will accomplish the same thing:

```
SYSCLR  
RUN 170000
```

► F

This command fills a specified range of memory with a specified number. It is generally only used during operating system development. The command format is:

F start end number

The contents of memory from location start to location end is filled with the value of number. Both start and end are of the form:

[sense/]wordno

However, if sense is specified for end, sense will not be used to determine the ending address (the fill operation will not cross a 128KB boundary). The sense-switch setting of the ending address will be the same as the sense-switch setting of the starting address. If sense is not specified for start, the default sense-switch setting is used. Any specification of sense on the command line, whether in start or end, will change bits 5-16 of the default sense-switch setting for subsequent commands.

► FETCH

This command fetches data according to the previously set sense and data switches. (See the descriptions of the SS and SD commands later in this appendix.) FETCH is generally only used as part of system test and maintenance procedures, or during operating system development.

The VCP will perform the CPU Fetch function and will then output the sense and data switch values followed by the results of the Fetch, each as a 16-bit word.

▶ HALT

(Prime 9950 only.)

This command is identical to the STOP command which is available on all Prime machines that have a VCP.

▶ HELP

(Prime 9950 only.)

This command displays the list of Diagnostic Processor commands available. If the display is sufficiently lengthy, the Diagnostic Processor will pause to allow the user to finish reading the first display. At this point, type CONTROL-P to abort the listing, or type any other character to continue displaying the rest of the list.

▶ LIGHTS

This command displays the current value of the lights register. It is generally only used during system test and maintenance, or during operating system development. The lights register is an internal communication path between the VCP and the CPU.

On the Prime 9950, the LIGHTS command may be abbreviated L.

▶ LIGHTISC

This command continuously samples the contents of the lights register, outputting the current value whenever it differs from the last value printed. It is generally only used during system test and maintenance, or during operating system development. The lights register is an internal communication path between the VCP and the CPU. To halt the output and return to Control Panel mode, type CONTROL-P.

On the Prime 9950, the LIGHTISC command may be abbreviated LC.

► LISTREV

(Prime 9950 only.)

This command will list the CPU type and the part number and required revision level for each board in the CPU. It will also list the CPU type for which the floppy disk inserted in the default disk drive is intended.

► MO ABS

This command causes the VCP to enter absolute addressing mode. The MO ABS command is generally only used during operating system development.

While in absolute addressing mode, all address specifications to VCP commands that reference main memory are interpreted as absolute (physical) memory addresses. To return to the default mode, mapped addressing mode, issue the MO MAP command.

This command sets bits 1, 2, and 4 of the default sense-switch setting as follows:

<u>Bit</u>	<u>Setting</u>
1	Off
2	Off
4	On

► MO BRIEF

(Prime 9950 only.)

This command causes the Diagnostic Processor to enter limited diagnostic message mode. This is the default mode when the system is powered-up. While in this mode, limited information will be displayed with diagnostic messages.

To change to full diagnostic message mode, issue the MO FULL command, described below.

► MO FULL

(Prime 9950 only.)

This command causes the Diagnostic Processor to enter full diagnostic message mode. While in this mode, complete information will be displayed with diagnostic messages. This mode is generally only used by Customer Service Representatives.

To return to the default mode of displaying only limited diagnostic messages, issue the MO BRIEF command.

► MO MAP

This command causes the VCP to enter mapped addressing mode. This is the default mode when the system is powered-up.

While in mapped addressing mode, all address specifications to VCP commands that reference main memory are interpreted as mapped (virtual) memory addresses. To change to absolute addressing mode, issue the MO ABS command. Absolute addressing mode is generally only used during operating system development.

The MO MAP command sets bits 1, 2, and 4 of the default sense-switch setting as follows:

<u>Bit</u>	<u>Setting</u>
1	Off
2	Off
4	Off

► MO RFABS

This command causes the VCP to enter absolute register set addressing mode. This command is generally only used during operating system development.

While in absolute register set addressing mode, all address specifications to VCP commands that reference main memory are interpreted as references to absolute registers instead. The sense portion of all such references is ignored, except that it will change bits 5-16 of the default sense-switch setting. Bits 9-16 of the wordno portion determine the register number (bits 12-16) and the register file (bits 9-11). (On machines other than the Prime 9950, bit 9 is ignored.) Bits 1-8 of wordno are ignored.

To return to the default mode of referencing mapped memory, issue the MO MAP command.

The MO RFABS command sets bits 1, 2, and 4 of the default sense-switch setting as follows:

<u>Bit</u>	<u>Setting</u>
1	On
2	On
4	On

Because bit 4 is turned on, MO RFABS also does an implicit MO RFH.

► MO RFCRS

This command causes the VCP to enter current register set addressing mode. This command is generally only used during operating system development.

While in current register set addressing mode, all address specifications to VCP commands that reference main memory are interpreted as references to registers in the current register set instead. The sense portion of all such references is ignored, except that it will change bits 5-16 of the default sense-switch setting. Bits 12-16 of the wordno portion determine the register number in the current register set. Bits 1-11 of wordno are ignored.

To return to the default mode of referencing mapped memory, issue the MO MAP command. To reference registers in register sets other than the current register set, issue the MO RFABS command.

The MO RFCRS command sets bits 1, 2, and 4 of the default sense-switch setting as follows:

<u>Bit</u>	<u>Setting</u>
1	On
2	Off
4	On

Because bit 4 is turned on, MO RFCRS also does an implicit MO RFH.

► MO RFH

This command specifies that the high-order half of an accessed register is to be modified. It is generally only used during operating system development. While accessing the register file using the register form of the A command, entering a new value for a register will modify the high-order 16-bit word of the register. To modify the low-order half, issue the MO RFL command. The default mode when the system is powered-up is MO RFL.

In addition to affecting the way the A command behaves when accessing registers by name, this command affects the way registers are displayed and modified when specified by number. This command may even have the same effect as a MO ABS command, since MO RFH sets bits 1, 2, and 4 of the default sense-switch setting as follows:

<u>Bit</u>	<u>Setting</u>
1	Unchanged
2	Unchanged
4	On

If bit 1 is already set (via a MO RFCRS or MO RFABS command), then MO RFH will cause the high-order half of registers to be accessed when addresses are specified to VCP commands. If bit 1 is reset, then MO RFH has the same effect as MO ABS, and registers will not necessarily be accessed when addresses are specified to VCP commands. Instead, absolute memory will be referenced.

► MO RFL

This command specifies that the low-order half of an accessed register is to be modified. It is generally only used during operating system development. While accessing the register file using the register form of the A command, entering a new value for a register will modify the low order 16-bit word of the register. To modify the high order half, issue the MO RFH command. The default mode when the system is powered-up is MO RFL.

In addition to affecting the way the A command behaves when accessing registers by name, this command affects the way registers are displayed and modified when specified by number. The MO RFL command may even have the same effect as a MO MAP command, since MO RFL sets bits 1, 2, and 4 of the default sense-switch setting as follows:

<u>Bit</u>	<u>Setting</u>
1	Unchanged
2	Unchanged
4	Off

If bit 1 is already set (via a MO RFCRS or MO RFABS command), then MO RFL will cause the low-order half of registers to be accessed when addresses are specified to VCP commands. If bit 1 is reset, then MO RFL has the same effect as MO MAP, and registers will not necessarily be accessed when addresses are specified to VCP commands. Instead, mapped memory will be referenced.

► MO ST

This command causes the supervisor terminal to be placed in Supervisor Terminal mode. It is often used following the use of the <ESCAPE><ESCAPE> sequence (pressing the ESCAPE key twice), which places the supervisor terminal in Control Panel mode.

While in Supervisor Terminal mode, all input and output at the supervisor terminal is controlled by PRIMOS or PRIMOS II. When running PRIMOS, the supervisor terminal is logged in as SYSTEM, user 1, and has extended capabilities that are fully discussed in Volume II of this book.

To change from Supervisor Terminal mode to Control Panel mode, type <ESCAPE><ESCAPE> (press the ESCAPE key twice). Note that if the operating system halts the CPU while the supervisor terminal is in Supervisor Terminal mode, the supervisor terminal will be automatically placed in Control Panel mode after a message concerning the CPU halt is printed.

► MO USER

(Prime 2250 and 9950 only.)

This command causes the supervisor terminal to be placed in User Terminal mode. It is often used following the use of the <ESCAPE><ESCAPE> sequence (pressing the ESCAPE key twice) to exit Supervisor Terminal mode.

While in User Terminal mode, all input and output at the supervisor terminal is routed through a special terminal port. Normally, this terminal port is connected to the CPU as a terminal user. When this is the case, User Terminal mode may be used to utilize the supervisor terminal as a normal user terminal. While in User Terminal mode, the supervisor terminal enjoys no special privileges other than those granted by PRIMOS based on the user's login name.

To return to Control Panel mode, type <ESCAPE><ESCAPE> (press the ESCAPE key twice). At this point, Supervisor Terminal mode may be entered by issuing the MO ST command. Note that if the operating system halts the CPU while the supervisor terminal is in User Terminal mode, the supervisor terminal will be automatically placed in Control Panel mode after a message concerning the CPU halt is printed.

If the front panel keyswitch is in the LOCK position, any attempt to use <ESCAPE><ESCAPE> to exit User Terminal mode will be ignored. This is useful if EMACS is being used at the supervisor terminal. While the keyswitch is in the LOCK position, the <ESCAPE><ESCAPE> sequence that normally places the supervisor terminal in Control Panel mode will instead be transmitted to EMACS.

Notes

While in User Terminal mode, messages sent to user 1 (the supervisor terminal) by PRIMOS or users may not be seen at the supervisor terminal. This is because the supervisor terminal is in fact connected to PRIMOS as a user terminal. However, if the SYSOUT INT command was issued while in Control Panel mode, messages to user 1 will be displayed on the supervisor terminal screen, interleaved with the normal display it receives as a user terminal. To respond to those messages, the user may have to enter Supervisor Terminal mode.

After entering User Terminal mode, the supervisor terminal may not respond to any typed characters. This will happen if PRIMOS is not fully started up, or if the special terminal port is not plugged into the system as a normal, operable user terminal line. To return to Control Panel mode, type <ESCAPE><ESCAPE> (press the ESCAPE key twice). Typing CONTROL-P will not work, since it will not be recognized by the VCP as an interrupt character, and will be sent through the special terminal port instead.

► RCP

This command is used to start the CPU running without entering Supervisor Terminal mode. The supervisor terminal is instead left in Control Panel mode. The command format is:

RCP [address]

address may be a virtual address if the CPU is in segmented mode. If address is not specified, the current value of PB is used. This means the CPU is started after the instruction it most recently executed. If address is specified on machines other than the Prime 9950, the sense and data switches are modified so as to change the value of PB. Therefore, any previous SS or SD commands are lost. On the Prime 9950, the settings specified by the most recent SS and SD commands are restored before execution begins. (See the System Architecture Guide for information on the PB register.)

address is of the form:

[sense/]wordno

If sense is not specified, the default sense-switch setting is used. If sense is specified, it also changes bits 5-16 of the default sense-switch setting.

This command is identical to the RUN command, except that it does not cause the supervisor terminal to be placed in supervisor terminal mode.

► REMPWD

(Prime 9950 only.)

This command is used to set the password on the remote port. It can be issued only from the local terminal. By setting a remote password, the user prevents unauthorized access to the remote port of the Diagnostic Processor, even if remote activities are enabled. (See Appendix C for information on Remote Diagnostics.)

After issuing the REMPWD command, the Diagnostic Processor will ask for the remote password. The user can then enter the password, which will not be echoed. This password cannot be longer than eight characters. It must consist only of alphabetic characters and digits, and the first character must be alphabetic. Lowercase characters will be mapped into uppercase. Entering only a carriage return sets a null password.

While the password is being set, the user may type CONTROL-P to return to Control Panel mode. If this is done, the existing password will not be changed.

The remote password is stored in a non-volatile portion of memory, and is therefore retained even when the system is powered-down.

Whenever the remote port is enabled and a connection is made to it, the password is requested of the remote user. If the password is entered correctly, the remote user is considered successfully connected to the remote port and may observe or issue Diagnostic Processor commands, depending on the setting of the remote privilege button.

If the password is not entered correctly, the remote user is asked for the password up to two more times. If the incorrect answer is given both times, or if 40 seconds elapses since the connection was first made, the remote user is disconnected.

► REV

This command is an abbreviation of the LISTREV command, described earlier in this chapter.

► RUN

This command is used to start the CPU running, and to enter Supervisor Terminal mode. The command format is:

RUN [address]

address may be a virtual address if the CPU is in segmented mode. If address is not specified, the current value of PB is used. This means the CPU is started after the instruction it most recently executed. If

address is specified on machines other than the Prime 9950, the sense and data switches are modified so as to change the value of PB. Therefore, any previous SS or SD commands are lost. On the Prime 9950, the settings specified by the most recent SS and SD commands are restored before execution begins. (See the System Architecture Guide for information on the PB register.)

address is of the form:

[sense/]wordno

If sense is not specified, the default sense-switch setting is used. If sense is specified, it also changes bits 5-16 of the default sense-switch setting.

On the Prime 9950, the RUN command may be abbreviated to R.

► SD

This command is used to set the data switches to a specified value. It is generally only used during system test and maintenance or during operating system development. The command format is:

SD number

The data switches are set to the value of number. The data switches are an internal communication path between the VCP and the CPU and are referenced when VCP commands such as FETCH are executed and also when PRIMOS or certain system test and maintenance routines are running.

Note

On machines other than the Prime 9950, many VCP commands will destroy the value in the data switches as prepared by the SD command. This is true of any command that accepts an address or register name. Certain commands, such as FETCH and STORE, cause the CPU to use the data switches as set by the SD command. Some programs use the data switches when they run — however, the RUN and RCP commands must be given with no arguments, or the value of the data switches will be lost.

To simulate a RUN or RCP command with an address, modify location 7 to contain the desired address, then enter the SD command, then issue the RUN or RCP command.

This is not necessary on the Prime 9950 as the sense and data switches specified by the SS and SD commands will always be restored after the sense and data switches themselves are changed to perform a requested operation.

► SETIME

(Prime 9950 only.)

This command sets the date and time for the Diagnostic Processor battery backed-up clock. Its use should be somewhat rare, since the date and time are maintained even when the system is powered-down. The command format is as follows:

```
SETIME -mmddyy -hhnrw [-D]
```

The fields have the following meanings:

<u>Field</u>	<u>Meaning</u>
mm	Month of the year. Ranges from 01 to 12.
dd	Day of the month. Ranges from 01 to 31.
yy	Year minus 1900. Ranges from 00 to 99.
hh	Hour of day. Ranges from 00 to 23.
nn	Minute of hour. Ranges from 00 to 59.
w	Day of the week. Ranges from 1 to 7. 1=Sunday.

The day of the week, w, is not checked against the specified date (mmddyy) to make sure it is a legal date. However, it is maintained as time passes, and is used by the Diagnostic Processor to report the day of the week to the user via the DATE command. Use the following table to determine the value of w:

<u>Day of Week</u>	<u>w</u>
Sunday	1
Monday	2
Tuesday	3
Wednesday	4
Thursday	5
Friday	6
Saturday	7

The -D option specifies that the daylight savings time option is to be enabled. If enabled, it causes the time to automatically increment from 1:59:59 A.M. to 3:00:00 A.M. on the last Sunday in April, and to be automatically set to 1:00:00 A.M. the first time it reaches 1:59:59 A.M. on the last Sunday in October. Even if the -D option is specified, the time must be specified based on the current time standard, whether Standard or Daylight Savings. The Diagnostic Processor assumes that the time is correct as entered for the date given and does not compensate for Daylight Savings time. This means that you simply enter the time as you know it. Do not worry about adding or subtracting one hour.

Although the Diagnostic Processor battery backed-up clock will automatically compensate for changes to and from Daylight Savings time, PRIMOS will not compensate accordingly. PRIMOS only reads the date and time from the Diagnostic Processor clock whenever it is coldstarted or warmstarted. Therefore, during the last Sunday in April or October, the PRIMOS and Diagnostic Processor clocks may be out of phase by one hour.

If the -D option is not specified, no automatic adjustment will be made to the date and time. Any changes in local time standards must be manually made to the Diagnostic Processor clock using the SETIME command.

Note

Although the SETIME command in Control Panel mode closely resembles the SETIME command entered while running PRIMOS in supervisor terminal mode, there are two subtle differences:

- The PRIMOS SETIME command does not recognize the -D option.
- The Diagnostic Processor SETIME command requires the day of the week to be specified, whereas PRIMOS calculates this.

► SPINDOWN

(Prime 2250 only.)

This command must be issued before system power is turned off, but after the CPU is halted. It instructs the 68MB and 158MB disks to spin down in an orderly fashion. When you hear the disks stop spinning, you may turn the system power off.

► SS

This command is used to set the sense switches to a specified value. It is generally only used during system test and maintenance, or during operating system development. The command format is as follows:

SS number

The sense switches are set to the value of number. The sense switches are an internal communication path between the VCP and the CPU, and they are referenced when VCP commands such as FETCH are executed and also when PRIMOS or certain system test and maintenance routines are running.

Note

On machines other than the Prime 9950, many VCP commands will destroy the value in the sense switches as prepared by the SS command. This is true of any command that accepts an address or register name. Certain commands, such as FETCH and STORE, cause the CPU to use the sense switches as set by the SS command. Some programs use the sense switches when they run; however, the RUN and RCP commands must be given with no arguments or the value of the sense switches will be lost.

To simulate a RUN or RCP command with an address, modify location 7 to contain the desired address, then enter the SS command, then issue the RUN or RCP command.

This is not necessary on the Prime 9950 as the sense and data switches specified by the SS and SD commands will always be restored after the sense and data switches themselves are changed to perform a requested operation.

► SSTEP

This command single steps the CPU through a specified number of instructions. It is generally only used during operating system development. The command format is as follows:

SSTEP number

number is the number of instructions to execute. As with all numerical input for VCP commands, it is interpreted according to the data representation mode, which is normally octal (:O). Therefore, SSTEP 10 means step through 8 instructions. If number is not specified, only one instruction is executed.

After each instruction is executed, the CPU is halted. When the final instruction (specified by number) is executed, the standard CPU halted message is displayed.

Note

On the Prime 9950, the number parameter is optional. If it is not specified, it defaults to 1.

On all other Prime machines, the SSTEP commands behaves as the TRACE command does on the Prime 9950. The CPU halted message is displayed for each executed instruction. In addition, the number parameter is required.

► STEP

This command single steps the CPU through the instruction stream until it has executed the instruction at the specified address, or until just before it executes the instruction at the specified address, depending on the CPU type. It is generally only used during operating system development. The command format is as follows:

STEP address

address is the address of the last instruction to be executed (on a Prime 9950) or the address of the first instruction to not be executed (on other Prime machines). After each instruction is executed, the CPU is halted, and the standard CPU halted message is displayed. If the address of the instruction that was just (or is about to be) executed is not equal to address, then the next instruction is executed, and the CPU halts again. The resulting output provides a trace of the path of the CPU through an instruction stream.

Note

Although address may include a sense-switch setting, using the form sense/wordno, the sense-switch setting of address and the PB register are ignored when the check is made to see if the addresses are equal. Only the wordno portion of address is compared to the word number of the PB register. Specifying sense, however, will set bits 5-16 of the default sense-switch setting to sense.

Also, keep in mind that the precise behavior of the STEP command differs between the Prime 9950 and other machines. On the Prime 9950, the instruction at the specified address is the last instruction executed before returning to control panel mode. On other machines, the instruction at the specified address is not executed — the operation is stopped when that instruction is about to be executed.

► STOP

This command halts the CPU and prints a message concerning the address at which the CPU halted. It is used to shut down PRIMOS II or to stop PRIMOS if it appears to be hung. The address displayed as part of the CPU halted message represents the address of the next instruction to be executed. In addition to this address, the contents of the address in main memory are displayed as a 16-bit word.

If there is no response to the STOP command, press the button labeled MASTER CLEAR on the control panel. If this does not produce a response, contact your Customer Service Representative.

► STORE

This command stores specified data according to the previously set sense and data switches (see the SS and SD commands). It is generally only used as part of system test and maintenance procedures or during operating system development.

The VCP will perform the CPU Store function and it will then output the sense and data switch values followed by the results of the Store, each as a 16-bit word.

► SYSCLR

This command performs a limited Master Clear function -- only the CPU and I/O controllers receive the Master Clear signal. The VCP is not reinitialized.

A CPU verified message should be issued shortly after this command is given. If there is no response or an error message is issued, try pressing the Master Clear button on the control panel. If this fails, contact your Customer Service Representative.

On the Prime 9950, the SYSCLR command may be abbreviated S.

► SYSOUT

This command controls the disposition of supervisor terminal output from PRIMOS while the supervisor terminal is in control panel or user terminal mode. It is often used to allow supervisor terminal output to appear on the supervisor terminal, interleaved with user terminal output, when the supervisor terminal is in User Terminal mode. The command format is as follows:

$$\text{SYSOUT} \left\{ \begin{array}{l} \text{BUFF} \\ \text{IGN} \\ \text{INT} \end{array} \right\}$$

If BUFF is specified, output from the supervisor terminal (user 1 under PRIMOS) will only be displayed when the supervisor terminal is in Supervisor Terminal mode. If this is not the case, the output will be stored in a buffer until the supervisor terminal is next placed in Supervisor Terminal mode, at which point the stored output will be displayed.

If IGN is specified, output from the supervisor terminal (user 1 under PRIMOS) will only be displayed when the supervisor terminal is in Supervisor Terminal mode. If this is not the case, the output will be discarded (ignored).

If INT is specified, output from the supervisor terminal (user 1 under PRIMOS) will always be displayed. This will occur even if it causes output from Control Panel or User Terminal mode to be interleaved with output from the supervisor terminal. This is the preferred mode, since it causes the user of the supervisor terminal to be made aware immediately whenever a message is sent to user 1 by either PRIMOS or a user requesting assistance.

The default mode when the system is powered-up is BUFF.

► TAPEDUMP

(Prime 9950 only.)

This command causes the CPU to do a memory dump to magnetic tape. It is only used when PRIMOS has halted, or been forcibly halted after it has apparently hung, and only when the cause of the halt or hang is unknown. The command format is as follows:

TAPEDUMP unit

unit is the tape unit on which to perform the tape dump. (It ranges from 0 to 3.) If the wrong tape unit is specified or the tape drive is off-line, not ready, or not write-enabled, the CPU will immediately halt. At this point, the problem should be fixed, and the TAPEDUMP command should be re-issued.

For machines that do not support the TAPEDUMP command, the following command sequence will perform a tape dump on Drive 0:

```
SYSCLR
RUN 775
```

To perform the tape dump on Drive 1:

```
SYSCLR
RUN 776
```

To perform the tape dump on any drive unit:

```
SYSCLR
A 7
775
/          (no CR need be typed)
SS unit
RUN
```

After the tape has been written, it will begin rewinding, and the CPU will halt. At this point, a warmstart may be attempted.

► TRACE

(Prime 9950 and 2250 only.)

This command single steps the CPU through a specified number of instructions. It is generally only used during operating system development. The command format is:

TRACE number

number is the number of instructions to execute. As with all numerical input for VCP commands, it is interpreted according to the data representation mode, which is normally octal (:0). Therefore, TRACE 10 means step through 8 instructions. If number is not specified, only one instruction is executed.

After each instruction is executed, the CPU is halted, and the standard CPU halted message is displayed. If there are more instructions to execute, then the next instruction is executed, and the CPU halts again. The resulting output provides a trace of the path of the CPU through an instruction stream.

Note

On the Prime 9950, the number parameter is optional. If it is not specified, it defaults to 1.

► VIRY

This command performs a complete system Master Clear. It resets the VCP, CPU, and I/O controller boards. It performs verification procedures on the VCP and CPU. If these verification procedures do not complete successfully, one or more error messages may be printed, or the machine may appear to hang for more than ten seconds. In this case, try pressing the Master Clear button on the control panel. If this doesn't work, contact your Customer Service Representative.

On a Prime 9950, the VIRY command takes a long time to execute, because of the exhaustive verification sequence performed on the equipment. It is recommended that the SYSCLR command be used instead. (The SYSCLR command may be abbreviated to S on the Prime 9950.) In addition, the VIRY command also sets the default floppy disk drive number to 0 on the Prime 9950.

► VPSD

(Prime 9950 and 2250 only.)

This command starts up the operating system debugger VPSD. It is generally only used during operating system development. The supervisor terminal is placed in Supervisor Terminal mode. This command must not be used unless both of the following conditions are true:

- PRIMOS was up and running before halting or being forcibly halted.
- The VPSD directive was present in the coldstart configuration file when PRIMOS was started up.

If either of these conditions are not true when the VPSD command is issued, unexpected results may occur. If this happens, you may have to press the Master Clear button on the control panel to clear the error condition.

On machines that do not support the VPSD command, the following command sequence will achieve the same objective:

```
SYSCLR
RUN 600
```

For information on VPSD, see the Assembly Language Programmer's Guide.

► WARMSTART

(Prime 9950 only.)

This command attempts a warmstart of PRIMOS. It is issued after PRIMOS has unexpectedly halted, or after PRIMOS is forcibly halted following an apparent system hang. It should not be used if PRIMOS was not running at the time of the halt.

The supervisor terminal will be automatically placed in supervisor terminal mode. However, as always, if the CPU subsequently halts, the supervisor terminal will be returned to Control Panel mode.

On machines that do not support the WARMSTART command, the following command sequence will accomplish the same thing:

```
SYSCLR
RUN
RUN
```


Note

Please allow one or two minutes for PRIMOS to print the message:

***** WARM START *****

As of Rev. 19.1, the warmstart procedure can be lengthy if certain I/O controllers such as ICS1 are present in the system.

NUMERICAL REPRESENTATION

The VCP outputs most numerical data in octal, and it expects all numerical input (such as the BOOT value) to be represented in octal. This is the numerical representation to be used for general VCP operation. If system test and maintenance activities are being performed, or an operating system is being debugged, the user may wish to change the numerical representation. This is done using the format specifiers, described in Control Panel Mode Operator Commands earlier in this chapter.

Note

Changing the numerical representation mode does not affect certain numerical output. The message that is output when the CPU halts will always include the address and contents of the halt in octal. On the Prime 9950, microdiagnostic test failure numbers and control store discrepancies are always reported in hexadecimal.

Although the numerical representation mode may be changed, this book assumes that the numerical representation mode is octal, unless otherwise specified. After a VCP session in which the numerical representation mode is changed, it is recommended that the numeric representation mode be returned to octal, so that subsequent use of the VCP by others will not result in misinterpretation of commands or output.

VCP-TO-CPU REGISTERS

There are several communication paths between the VCP and the CPU. They are of little concern to the operator who is performing normal system functions using the VCP. However, a user who is debugging an operating system or running system test and maintenance routines should be aware of them.

The VCP itself may be considered an intelligent interface to the control panel of a Prime 400. (See Chapter 18 and Appendix D for complete information on the control panel of a Prime 400.)

The elements of a Prime 400 control panel are as follows:

- A rotary switch to select the mode of the CPU.
- A START switch to perform a CPU function based on the setting of the rotary switch.
- A MASTER CLEAR switch to initialize the CPU and I/O devices when the rotary switch is not in the RUN or LOAD position.
- A STOP light that is lit when the CPU is in the stopped state.
- A data register used to hold the contents of memory when data is being fetched or stored.
- An address register used to specify the word number in memory, or the register number, where the CPU stopped, or where data is being fetched or stored.
- A DATA CLEAR switch to clear the data or address register.
- An ADDRESS/DATA switch to select the data or address register.
- Sixteen data entry switches, each with three positions. The top position sets the corresponding sense switch. The middle position resets the corresponding sense switch. The down position, a momentary contact, sets the corresponding data switch. These switches are used to set the data and address registers when the CPU is stopped. The data or address registers are reset by pressing the DATA CLEAR button.
- Sixteen lights to display the current setting of the data or address register.

The VCP essentially provides a convenient interface to this control panel. The control panel itself does not exist on a machine with a VCP, but the CPU contains the registers it represents, and the VCP uses these registers to communicate with the CPU.

For example, when a BOOT command is issued, the VCP performs the equivalent of setting the sense switches to the value specified, turning the rotary knob to LOAD and pressing the START switch.

Although the VCP performs most of its functions by implicitly manipulating this "virtual" control panel (from which the name VCP is derived), it does provide the user with the ability to directly control this virtual control panel without any interference from the VCP.

Some examples of this ability follow:

- The SS and SD commands can be used to set the sense and data switches.
- The FETCH command can be used to perform a FETCH operation based on the current sense switches and address register. The result, which is put in the data register by the CPU, is then displayed by the VCP.
- The STORE command stores a value in memory based on the current sense switches and address register, storing the value set in the data register as specified on the STORE command line.
- The LIGHTS command displays the current value of the data lights.

Although the registers involved here are only 16 bits wide, many of the functions involve values larger than 16 bits. For example, accessing main memory on a Prime 9950 involves 23 bits when accessing physical memory and 28 bits when accessing mapped memory.

To provide this functionality, the VCP communicates additional addressing information to the CPU through the sense switches, whenever it performs an operation involving memory or register addressing. Prime systems also use the sense switches to determine certain settings, allowing the user to access more than the first 128KB of memory and to access registers.

Understanding the sense-switch register is crucial when the VCP user is accessing main memory or registers. This is often the case when the user is debugging an operating system.

SENSE SWITCH SETTINGS

When using certain VCP commands, a default sense-switch setting is assumed. This setting is used by the VCP to indicate the precise nature of the addressing to be performed by the CPU. When the VCP is first powered up, the default sense-switch setting is zero ('000000). Normally, the VCP sets the sense switch setting automatically.

An operator using the VCP for standard procedures need not be concerned with sense-switch settings. When debugging an operating system, however, knowledge of this aspect of the VCP-to-CPU interface is important.

When the VCP requests information from or provides information to the CPU, the sense-switch setting is often used to provide additional information concerning the operation. However, at times the automatic setting is not desired or may be inconsistent with the user's wishes.

In these cases, it is important to understand how the VCP manipulates the sense switches, so that the user may both interpret the settings constructed by the VCP and construct his or her own settings.

There are four ways the sense switches are interpreted, and they depend on the current mode of the CPU:

1. When the CPU is stopped, the CPU itself interprets the sense switches along with the address register. Sense switches select register files, mapped memory, or absolute memory. The address register specifies the location — a word or register number. On the VCP, setting the data switches when the CPU is stopped also sets the address register but does not set the data register.
2. When the system is being started up, each phase of the BOOT procedure interprets the sense switches to determine what the kind of BOOT is being performed. The pre-boot uses the sense switches to select the device. The BOOT program uses the sense switches to determine whether to select the device automatically or input the device number from the user. When PRIMOS II is booted, it uses the sense switches to determine whether to automatically start up PRIMOS.
3. When PRIMOS is running on the CPU, the sense and data switches are interpreted by PRIMOS. Sense switches select a word in memory. Data switches are used to select the segment number. PRIMOS displays the contents of the specified word in the lights.
4. When running system test and maintenance routines, these routines often use the sense and data switches to determine their behavior. In fact, the sense and data switches and the data lights often function as the user interface for these routines, so that they may be used even when the supervisor terminal itself is faulty.

Sense Switch Meaning When CPU Stopped

When the CPU is in the stop state, the address register specifies the word number in memory to be operated on and the sense switches control the mode of addressing to be performed. For example, the sense-switch setting may indicate that main memory addresses are to be mapped according to the virtual memory mapping currently in place. In this case, the low-order 12 bits of the sense-switch setting specifies the segment number and the address register specifies the location within the segment. Another sense-switch setting may specify that a requested address applies to a register file, not a main memory address. Here, the low-order 12 bits of the sense-switch setting is ignored and the low-order 5 bits of the address register specifies the register number.

Bit 1 of the sense-switch register is the most important. It controls whether the access is made to main memory or to a register. The remainder of the sense switches and address register are used to specify the main memory address (in mapped or absolute terms) or the register number (current or absolute register set). The various settings and meanings of the sense switches and address register are illustrated in Figure A-1 on the next page.

Specifying a Register: If bit 1 is set, the word number part of the specified address (in the address register) represents a register address. In this case, bits 2 and 4 of the sense-switch setting control which of four register sets (six on the Prime 9950) are accessed and which half of the specified register is accessed, as follows:

<u>Bit</u>	<u>Off</u>	<u>On</u>
2	Reference current register set, bits 9-11 of address register are ignored	Reference absolute register set, bits 9-11 of address register specify the register set number
4	Reference low half	Reference high half

Bit 3 of the sense-switch setting must be zero. Bits 5 through 16 of the sense-switch setting are ignored, and should be zero. Bits 1 through 8 of the address register are always ignored, and bits 12 through 16 of the address register specify the register number.

Specifying Main Memory: If bit 1 of the sense-switch register is reset, the address register represents the word number part of a main memory address. In this case, bit 4 of the sense-switch register controls whether the access is done through mapped (virtual) memory or absolute (physical) memory as follows:

<u>Bit</u>	<u>Off</u>	<u>On</u>
4	Reference mapped memory, bits 5-16 of sense switch register is segment number	Reference absolute memory, bits 10-16 of sense-switch register are high-order bits of 23-bit physical address

Sense Switches

Address Register

0 0 0 h - - i g n o r e d - - -	0 0 0 0 0 0 0 0 0 0 0 0 r r r r r
---------------------------------	-----------------------------------

Implicit Register Access
 (16S, 32S, 32R, or 64R mode, or segmentation disabled)
h is set for high half of register

0 0 0 h - - i g n o r e d - - -	0 0 0 0 0 0 0 0 0 0 0 0 0 0 r r r
---------------------------------	-----------------------------------

Implicit Register Access
 (64V or 32I mode when segmentation enabled)
h is set for high half of register

0 0 0 0 - - - s e g n o - - - -	- - - - - w o r d n o - - - - -
---------------------------------	---------------------------------

Mapped Memory Access

0 0 0 1 0 0 0 0 0 0 b b b b b b b	- - - - - w o r d n o - - - - -
-----------------------------------	---------------------------------

Absolute Memory Access
b represents high-order bits of address

1 0 0 h - - i g n o r e d - - -	- - i g n o r e d - - r r r r r
---------------------------------	---------------------------------

Current Register Set Access
h is set for high half of register

1 0 0 h - - i g n o r e d - - -	i g n o r e d - s s s r r r r r
---------------------------------	---------------------------------

Absolute Register Set Access
h is set for high half of register
s specifies the register set number

Sense Switch Meanings When CPU Stopped
 Figure A-1

Special Cases When Specifying Main Memory: Even if bit 1 of the sense-switch register is reset, the reference may be to a register rather than main memory. This will be the case if the CPU is in 16S, 32S, 32R, or 64R mode, and if the specified word number is less than '40. A register reference also occurs if the machine is in 64V or 32I mode, depending on whether segmentation is turned on:

- If segmentation is enabled, a word number of less than '10 references a register.
- If segmentation is not enabled, a word number of less than '40 references a register.

(The mode of the CPU is determined by looking at the KEYS register, and the MODALS register contains the indicator of whether the CPU is in segmented mode or not. See the Assembly Language Programmer's Guide for further information.)

Whenever a register is accessed, either implicitly (due to the range checking) or explicitly (by setting bit 1 of the sense-switch register), bit 4 of the sense-switch register determines whether the low or high half of the register is read or written. When the VCP commands A or D are used and a register is specified by name, the VCP automatically performs the necessary steps to display both the high and low halves of the specified register. However, during an A command, only the high or low half of a register may be modified, depending on the setting of bit 4 of the default sense switch.

Sense-Switch Setting During Boot Process

When the system is being booted, various phases of the boot process interpret the sense-switch setting to determine what kind of boot is being performed. For complete information on the sense-switch setting for the boot process, see Appendix E.

Sense-Switch Setting While Running PRIMOS

As a debugging aid, PRIMOS allows the control panel user to view a single word in memory and observe it changing as the system runs. This can be useful when a Prime 350, 400, or 500 is the system being used because the contents of the word are displayed in the data lights. However, on machines with a VCP, the VCP must continually output the changing contents on the supervisor terminal when the LIGHTSC or DISPLAYC commands are given. This may cause any sense of timing to be lost.

While PRIMOS is running, the setting of the sense switches specifies the word number in a segment to be accessed. The data switches are used to set the segment number. PRIMOS continually displays the

contents of this word in the data lights register. See Figure A-2 for an illustration of the use and meaning of the sense and data switches while PRIMOS is running.

The DISPLAY and DISPLAYC commands automatically set up both the word number (using the sense switches) and the segment number (using the data switches). However, the VCP user may do this by using the SS and SD commands to manipulate the segment and word number, and by using the LIGHTS or LIGHTSC command to output the value in the data lights.

To set the word number using this alternate method, type:

SS wordno

To set the segment number, first type:

SD 140000

This clears the segment number, setting it to zero. Then, type:

SD 10ssss

SD 0

Substitute the four-digit octal segment number for ssss. Now, enter the LIGHTSC command to view the contents of the location. To stop the output and return to Control Panel mode, type CONTROL-P.

Sense-Switch Setting During System Test and Maintenance

Many system test and maintenance programs interact with the user through the sense and data switches. Because they require the sense and data switches to remain set during the execution of the program, certain VCP commands should not be issued once the sense and data switches are set up. In particular, on all machines except the Prime 9950, any VCP command that accepts an address or register argument will disrupt the current sense and data switch settings. (On the Prime 9950, the disruption will be temporary. The switch settings as specified by the user will be restored after each Diagnostic Processor command.)

Therefore, to set up sense and data switches and then start running a program at a specific address, the address must be loaded into the P register (word 7) before the SS and SD commands are used to set up the sense and data switches. Then, the RUN or RCP command is given with no arguments.

Sense Switches

Data Switches

-----wordno-----

0-----ignored-----

Data lights contain contents of segno/wordno

-----wordno-----

10xx-----segno-----

Data lights contain segno
(Sets segno bits)

-----wordno-----

11-----ignored-----

Data lights contain 0
(Clears segno bits)

Sense Switch Meanings When PRIMOS Running
Figure A-2

Setting the Sense-Switch Register

There are four ways to set the sense switches as seen by the CPU:

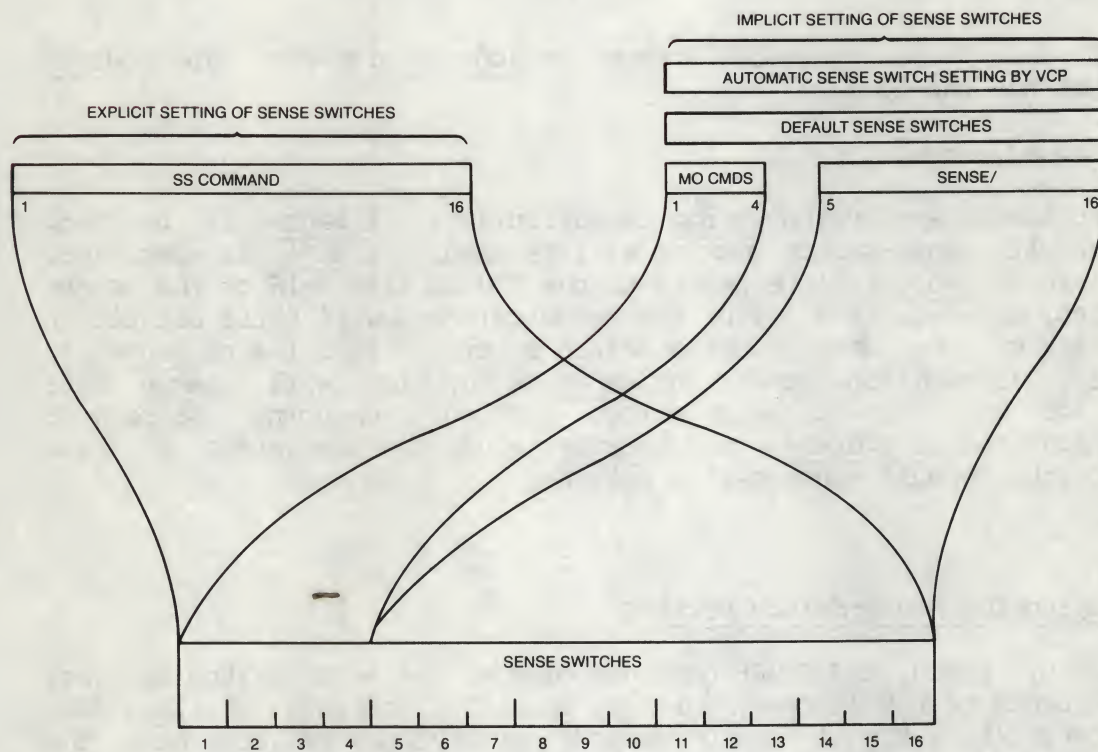
1. By implicitly requesting information from the VCP that causes it to automatically set the sense (and data) switches to honor the request.
2. By specifying MO commands that change bits 1-4 of the default sense-switch setting. These bits are always supplied by the VCP when an implicit reference to a sense-switch setting is made.
3. By specifying bits 5-16 of the sense-switch setting when entering an address to a VCP command. This not only affects the current command, but also sets bits 5-16 of the default sense switch setting. Bits 1-4 of the default sense-switch setting can only be changed by using the MO commands mentioned in item 2.
4. By explicitly setting the sense-switch setting using an SS command. This will cause the CPU to immediately see the new setting. Subsequent commands such as FETCH, STORE, LIGHTS, DISPLAY, RUN (without arguments), and RCP (without arguments), will cause the CPU to use the specified sense-switch setting. However, as soon as the VCP needs to change the sense-switch setting as seen by the CPU (because of a RUN command with an argument, for example), the setting specified by an SS command will be overridden. On a Prime 9950, this setting will be restored as soon as the Diagnostic Processor command that changed it is completed.

The interaction between these methods of setting the sense switches is shown in Figure A-3 on the next page.

The first method occurs when the VCP needs to set the sense and data switches to perform its functions. For example, when the CPU halts, the VCP must extract information from the CPU to produce the "CPU HALTED" message, and this extraction involves the automatic setting of the sense and data switches.

The second and third methods change the default sense-switch setting. (The default setting is initially 0.) The default sense-switch setting is used by all VCP commands that take a main memory address as an argument. These commands allow bits 5-16 of the default sense-switch setting to be changed when the command is executed, as explained below. However, bits 1-4 of the default sense-switch setting may only be changed via the MO commands.

The fourth method sets the sense switch values as seen by the CPU. (Similarly, the SD command sets the data switch values as seen by the CPU.) Setting the sense and data switches in this manner immediately changes the values as seen by the CPU, the results of which may be seen



Setting the Sense-Switch Register
Figure A-3

using commands such as LIGHTS, FETCH, STORE, etc. This setting is overridden whenever a VCP command is specified along with a main memory address. On the Prime 9950, the settings specified by the SS and SD command are restored after any operation which implicitly disrupts the sense and data switches (such as an A or D command). On other Prime machines, the values specified in an SS or SD command are lost as soon as such an operation is performed — the sense and data switches are left in the state that the operation (such as A or D) left them in. The following VCP commands assume a default sense-switch setting:

A
C
D
DISPLAY
DISPLAYC
F
RCP
RUN

All of the above commands accept an address argument. The address argument has the form:

[sense/]wordno

In most cases, specifying wordno is sufficient. If sense is omitted, the default sense-switch setting will be used. If sense is specified, bits 5-16 of sense will be passed to the CPU as bits 5-16 of the sense switches, although bits 1-4 of the sense switches will still default to bits 1-4 of the default sense-switch setting. Bits 1-4 of sense are ignored. In addition, specifying sense at any time will change bits 5-16 of the default sense-switch setting, changing subsequent specifications of address without sense to use the new values of bits 5-16 of the default sense-switch setting.

Displaying the Sense-Switch Setting

The A, D, FETCH, and STORE commands display the sense-switch setting, the contents of the address register, and the contents of the data register. (For the A and D commands specifying a register name, the data register contents are displayed twice — once for the high half, and once for the low half.)

The first number displayed is the sense-switch setting. The first four bits of this setting show what kind of access is being performed. When the address representation mode is octal (:O), the first four bits correspond to the first two digits. These bits correspond exactly to the sense switch bits 1 through 4 described above, under Sense-Switch Settings When CPU Stopped.

Normally, these two octal digits have one of the following six values:

<u>Value</u>	<u>Meaning</u>
00	Mapped main memory is accessed. The low-order 12 bits or 4 octal digits of the sense switches specify the segment number. The address register contains the word number within the segment. If this number is less than '10, or less than '40 and the CPU is not in 64V or 32I mode with segmentation enabled, the low half of a register is accessed, not main memory.
01	Absolute main memory is accessed. The contents of the sense switches (the low-order 7 bits or 3 octal digits) are the high-order 7 bits of the 23-bit physical memory address. The address register contains the low-order 16 bits of the 23-bit physical memory address. If this number is less than '10, or less than '40 and the CPU is not in 64V or 32I mode with segmentation enabled, the high half of a register is accessed, not main memory.
10	The low half of the current register set is accessed. The low-order 5 bits of the address register specify the register number.
11	The high half of the current register set is accessed. The low-order 5 bits of the address register specify the register number.
14	The low half of a specified register set is accessed. Bits 9 through 11 of the address register specify the register file number, and bits 12 through 16 (the low-order 5 bits) specify the register number.
15	The high half of a specified register set is accessed. Bits 9 through 11 of the address register specify the register file number, and bits 12 through 16 (the low-order 5 bits) specify the register number.

When the A or D command is used to access a register by name, both the high and low halves of the register are displayed. The sense-switch setting that is displayed in this case may not show the correct setting of bit 4, the high/low half bit. On the Prime 9950, this bit will always be on in this case. On other Prime machines, this bit has the same value as bit 4 of the default sense switches, and therefore reflects the setting of the last MO RFH/RFL command. However, since both halves of the register are displayed, bit 4 of the actual sense switches provided to the CPU is toggled to access this information.

B

Diagnostic Processor Messages

INTRODUCTION

This Appendix lists all of the messages that may be issued by the Diagnostic Processor for the Prime 9950. These messages fall into three categories:

- Informational messages
- Warning messages
- Error messages

In general, if you receive an error message, contact your System Administrator or Customer Service Representative immediately. If you receive a warning message that is unexpected, notify your System Administrator.

INFORMATIONAL MESSAGES

The following messages provide the operator with information regarding the current status of the system. The Diagnostic Processor displays them as part of normal system operation. These messages are self-explanatory.

DPM000: Diagnostic Processor Beginning Self Verification.
 DPM001: Diagnostic Processor Self Verification completed.
 DPM002: Beginning Central Processor System Verification, please wait.
 DPM003: Diagnostic "<filename>" successfully completed.
 DPM004: Central Processor System verified.
 DPM005: Beginning Central Processor System initialization, please wait.
 DPM006: Central Processor System initialization completed.
 DPM007: System Booting, please wait.
 DPM008: Microcode file "<filename>" successfully loaded.
 DPM009: Diagnostic "<filename>" beginning execution.
 DPM010: Test # <nnnn> successfully completed.
 DPM011: Microcode file "<filename>" successfully verified.
 DPM100: Main A.C. power resumed, UPS no longer active.
 System ready for Warm Start.
 DPM101: Automatic Warm Start in progress.
 DPM200: Remote terminal connected.
 DPM201: Remote terminal disconnected.
 DPM202: Please enter remote password:
 DPM300: Can't while CPU running.
 DPM301: Can't while Key Switch is locked.
 DPM302: Can't unless Microcode is running.
 DPM303: Can't unless Instruction Set Microcode is running.
 DPM304: Can't unless Decode Net loaded.
 DPM305: Can't unless Microcode loaded.
 DPM306: Test. #<nnnn> successfully completed.
 DPM307: Can't unless CPU running.
 DPM308: Decode Net file "<filename>" verification completed.
 DPM400: CPU halted at <address>
 DPM700: Power Fail.
 DPM701: Machine Check.
 DPM702: Missing Memory Module.
 DPM703: Memory Parity (ECCU).

WARNING MESSAGES

The following messages indicate that the diagnostic processor has detected and recovered from an error during system operation. For each warning message, a description of the failure will be given along with a number of possible causes of the failure in descending order of probability. Along with this information will be a brief description of the recovery procedures used by the diagnostic processor in order to continue system operation. Although these errors do not prevent operation of the system, they should be reported to a Customer Service Representative. Otherwise, the error condition may develop into a situation that will prevent system operation.

- WRN000: Verification continuing using alternate drive.

This message indicates that the initial floppy disk interface test in Diagnostic Processor self-verification failed and that the Diagnostic Processor will now attempt to use the other drive to continue with verification and ultimately autoboot to PRIMOS. This error would occur if the floppy disk media was missing from Drive 0 or if the door to Drive 0 was open. If this error occurs with a disk known to be valid in Drive 0, Customer Service should be contacted even though the Diagnostic Processor will still operate correctly from Drive 1.

- WRN001: <nn> Recoverable disk read error(s) occurred.

This warning indicates that soft read errors occurred while reading the floppy disk. This usually indicates that the floppy disk media is becoming worn out and should be replaced.

- WRN002: <nn> Recoverable verification error(s) occurred.

This message is printed out when a recoverable error is detected while loading the CPU microcode. If this error persists, the system integrity is maintained, but Customer Service should be contacted.

- WRN003: UPS System active, main A.C. power interrupted.

This message is printed out whenever the main A.C. power goes down on a system connected to an Uninterruptable Power Supply. The system will halt and wait for the power to be resumed before attempting to restart.

- WRN004: Mode specifier is not set to Octal.

The BOOT command is normally given with the sense switch setting in octal mode. This message indicates that the current sense switch is either in decimal, binary, or hexadecimal. The operation specified will continue using the current setting. If mode octal is desired, type CONTROL-P or <ESCAPE><ESCAPE> to abort the current command and use the ":0" command to specify mode octal setting.

- WRN005: Sysverify file not found.
Autoboot sequence terminated, entering Control Panel Mode.

A copy of the system verification microcode is not found during the microcode loading sequence. This warning will typically be displayed if an autoboot is attempted, and the floppy disk contains only microdiagnostics and is not a valid autoboot disk.

If this was not the case, use the DIR command while in Control Panel mode to make sure that a file type "S" exists on the floppy disk. If the file does not exist, make sure that the correct drive is being used by issuing a DIR :0 command to set the default drive number to 0. If the file does not exist on either drive, use a correct copy of the floppy disk. If the file does exist, try replacing the floppy disk, and enter the BOOTP command. Contact Customer Service if the error persists.

- WRN400: Diagnostic Processor shutting down System power.

This message will be printed just before the Diagnostic Processor shuts down system power in response to one of the environmental sensors being tripped.

ERROR MESSAGES

The following messages indicate that the diagnostic processor has detected an error that will prevent normal operation of the system. For each error, a description of the failure will be given along with a number of possible causes of the failure in descending order of probability of occurrence. In addition, any appropriate actions to be taken by the system operator prior to calling a Customer Service Representative will be outlined for each error category.

- ERR000: Diagnostic Processor memory error.

An error was detected when performing a verification of the contents of the diagnostic processor's bootstrap PROM memory at board location 05B. This would most likely be caused by a failing memory component and should be reported to your Customer Service office.

- ERR001: Diagnostic Processor memory error.

An error was detected when performing a verification of the operation of the memory component at board location 07B. This would most likely be caused by a failing memory component and should be reported to your Customer Service office.

- ERR002: Diagnostic Processor memory error.

An error was detected when performing a verification of the operation of the memory component at board location 09B. This would most likely be caused by a failing memory component and should be reported to your Customer Service office.

- ERR003: Diagnostic Processor memory error.

An error was detected when performing a verification of the operation of the memory component at board location 11B. This would most likely be caused by a failing memory component and should be reported to your Customer Service office.

- ERR004: Diagnostic Processor memory error.

An error was detected when performing a verification of the operation of the memory component at board location 13B. This would most likely be caused by a failing memory component and should be reported to your Customer Service office.

- ERR005: Diagnostic Processor memory error.

An error was detected when performing a verification of the operation of the memory component at board location 15B. This would most likely be caused by a failing memory component and should be reported to your Customer Service office.

- ERR006: Diagnostic Processor memory error.

An error was detected when performing a verification of the operation of the memory component at board location 17B. This would most likely be caused by a failing memory component and should be reported to your Customer Service office.

- ERR007: Diagnostic Processor memory error.

An error was detected when performing a verification of the operation of the memory component at board location 19B. This would most likely be caused by a failing memory component and should be reported to your Customer Service office.

- ERR008: Diagnostic Processor memory error.

An error was detected when performing a verification of the operation of the memory component at board location 21B. This would most likely be caused by a failing memory component and should be reported to your Customer Service office.

- ERR009: Diagnostic Processor memory error.

An error was detected when performing a verification of the operation of the memory component at board location 23B. This would most likely be caused by a failing memory component and should be reported to your Customer Service office.

- **ERR010: Diagnostic Processor memory error.**

An error was detected when performing a verification of the operation of the memory component at board location 25B. This would most likely be caused by a failing memory component and should be reported to your Customer Service office.

- **ERR011: Diagnostic Processor memory error.**

An error was detected when performing a verification of the operation of the memory component at board location 27B. This would most likely be caused by a failing memory component and should be reported to your Customer Service office.

- **ERR020: Diagnostic Processor Serial I/O error.**

An error was detected when performing the initial verification of the operation of the diagnostic processor's serial I/O interface to the local terminal port (supervisor terminal). This would most likely be caused by a hardware failure and should be reported to your Customer Service office.

- **ERR021: Diagnostic Processor serial I/O error.**

An error was detected when performing the initial verification of the operation of the diagnostic processor's serial I/O interface to the remote terminal port. This would most likely be caused by a hardware failure and should be reported to your Customer Service office.

The system may be operated in a "degraded" mode until the appropriate repairs are made by disabling the remote port at the system status panel. The operation of the status panel switches is explained in the system operator's manual.

- **ERR030: Diagnostic Processor Floppy Disk read error.**

An error was detected while trying to read and verify the disk check sector from track 34 sector 31 of the floppy disk. This error will occur for a number of reasons. Before reporting to your Customer Service office, make the following checks:

1. Is a valid floppy disk inserted in Drive 0?
2. Is the disk drive door closed?
3. Does the floppy disk represent the latest available revision?

If, while performing these checks, you discover the cause of the difficulty, fix the problem, and attempt the operation again. If the error persists, then the floppy disk media may be defective. Try using another floppy disk. If the error still persists, then the drive is probably bad and it should be reported to the Customer Service office.

- ERR031: Diagnostic Processor Floppy Disk read error.

An error has occurred while trying to validate the floppy disk for application software load. The floppy disk media is defective and should be replaced.

- ERR032: Diagnostic Processor Floppy Disk read error.

Floppy disk format identifier error. The floppy disk does not contain a valid format identifier field. The floppy disk media should be replaced with a valid Prime disk. If this error persists after replacing the media, the Customer Service office should be contacted.

- ERR033: Diagnostic Processor Floppy Disk read error.

Floppy disk contains wrong revision software. The revision level of the diagnostic processor code contained on the floppy disk does not match the current diagnostic processor hardware revision level. Customer Service should be contacted.

- ERR040: Diagnostic Processor Floppy Disk read error.

A read error was encountered while attempting to read the diagnostic processor software. An alternate floppy disk media should be tried. If the problem persists, contact Customer Service.

- ERR041: Diagnostic Processor Floppy Disk read error.

The floppy disk does not contain diagnostic processor software. Try using an alternate floppy disk media. If this error persists, contact Customer Service.

- ERR050: Diagnostic Processor error on CTC Channel 0.

The diagnostic processor detected an error during self-verification on Channel 0 of the Counter Timer Chip. Contact Customer Service.

- ERR051: Diagnostic Processor error on CTC Channel 1.

The diagnostic processor detected an error during self-verification on Channel 1 of the Counter Timer Chip. Contact Customer Service.

- ERR052: Diagnostic Processor error on CTC Channel 2.

The diagnostic processor detected an error during self-verification on Channel 2 of the Counter Timer Chip. Contact Customer Service.

- ERR053: Diagnostic Processor error on CTC Channel 3.

The diagnostic processor detected an error during self-verification on Channel 3 of the Counter Timer Chip. Contact Customer Service.

- ERR054: Diagnostic Processor CTC Interrupt error.

The diagnostic processor detected an error during self-verification of the Counter Timer Chip. Contact Customer Service.

- ERR060: Diagnostic Processor Serial I/O error on CPU Port.

The diagnostic processor detected an error during self-verification of the CPU Port. SIO (Serial Input/Output) chip at location 23E is probably defective. Contact Customer Service.

- ERR061: Diagnostic Processor Serial I/O error on Local Port.

The diagnostic processor detected an error during self-verification of the LOCAL Port. SIO (Serial Input/Output) chip at location 23E is probably defective. Contact Customer Service.

- ERR062: Diagnostic Processor Serial I/O error on System Port.

The diagnostic processor detected an error during self-verification of the System Port. SIO (Serial Input/Output) chip at location 19E is probably defective. Contact Customer Service.

- ERR063: Diagnostic Processor Serial I/O error on Remote Port.

The diagnostic processor detected an error during self-verification of the REMOTE Port. SIO (Serial Input/Output) chip at location 19E is probably defective. Contact Customer Service.

- ERR070: Diagnostic Processor detects insufficient air flow.

The diagnostic processor detected insufficient air flow during self-verification. Make sure that the cabinet blower is functioning and the air filter is clean. If this error persists, call Customer Service.

- ERR071: Diagnostic Processor detects high cabinet temperature.

The diagnostic processor detected that cabinet temperature was too high for reliable operation. Take appropriate actions to insure the room temperature falls within the specified range. If this error persists and the cabinet temperature is definitely within the specified limits, contact Customer Service.

- ERR072: Diagnostic Processor cabinet temperature sensor inoperative.

The diagnostic processor detected that the cabinet temperature sensing circuit was not working during self-verification. Contact Customer Service.

- ERR073: Diagnostic Processor board temperature sensor inoperative.

The diagnostic processor detected that the CPU circuit board temperature sensing circuit was not working during self-verification. Contact Customer Service.

- ERR074: Diagnostic Processor air flow sensor inoperative.

The diagnostic processor detected that the air flow sensing circuit was not working during self-verification. Contact Customer Service.

- ERR075: Diagnostic Processor detects power supply failure.

The diagnostic processor detected that one of the Central Processor system power supplies was not operating correctly. Contact Customer Service.

- ERR100: Failure detected in Microdiagnostic "<filename>", Test <nnnn>

[Most probable replaceable unit is <ORU1>]

[Second most probable replaceable unit is <ORU2>]

[Third most probable replaceable unit is <ORU3>]

[Fourth most probable replaceable unit is <ORU4>]

A microdiagnostic test has failed. The most probable optimal replaceable units are indicated. Contact Customer Service.

- ERR110: Verification file "<filename>" not found.

A copy of the microcode verification file is not found during the microcode loading sequence. Using the DIR command while in Control Panel mode, make sure that a file type "V" exists on the floppy disk and is located immediately after the microcode write copy. If the file does not exist, make sure that the correct drive is being used by issuing a DIR :0 command to set the default drive number to 0. If the file does not exist or if it is not located at the right place, use a correct copy of the floppy disk. If the file does exist and is at the right place, try replacing the floppy disk, and then issue a BOOTP command. If the error persists, contact Customer Service.

- ERR111: Microdiagnostic "<filename>" not found.

A copy of the microdiagnostic microcode is not found during the load Control Store sequence. Use the DIR command in Control Panel mode, and make sure that a file type "M" exists on the floppy disk. If the file does not exist, make sure that the correct drive is being used by issuing a DIR :0 command to set the default drive number to 0. If the file does not exist, use a correct copy of the floppy disk. If the file does exist, try replacing the floppy disk, and then issue the BOOTP command. Contact Customer Service if the error still persists.

- ERR114: Instruction set Microcode not found.

A copy of the instruction set microcode is not found during the load Control Store sequence. Use the DIR command while in Control Panel mode, and make sure that a file type "B" exists on the floppy disk. If the file does not exist, use a correct copy of the floppy disk. If the file does not exist, make sure that the correct drive is being used by issuing a DIR :0 command to set the default drive number to 0. If the file does exist, try replacing the floppy disk, and then issue the BOOTP command. Contact Customer Service if all else fails.

- ERR115: Decode Net file not found.

A copy of the decode net is not found during the load base instruction set microcode sequence. Use the DIR command while in Control Panel mode, and make sure that a file type "D" exists on the floppy disk. If the file does not exist, make sure that the correct drive is being used by issuing a DIR :0 command to set the default drive number to 0. If the file does not exist, use a correct copy of the floppy disk. If the file does exist, try replacing the floppy disk, and then issue the BOOTP command. Contact Customer Service if the error persists.

- ERR116: PRIMOS Boot routine file not found.

A copy of the PMA boot file is not found during the boot to PRIMOS sequence. Use the DIR command while in Control Panel mode, and make

sure that a file type "P" exists on the floppy disk. If the file does not exist, make sure that the correct drive is being used by issuing a DIR :0 command to set the default drive number to 0. If the file does not exist, use a correct copy of the floppy disk. If the file does exist, try replacing the floppy disk, and then issue the BOOTP command. Contact Customer Service if all else fails.

- ERR117: Decode Net Verification error.

The Diagnostic Processor fails in verifying the Decode net. Contact Customer Service.

- ERR118: Decode Net file "<filename>" not found.

A copy of the file type D of the given name cannot be found. Follow the same error handling described for ERR115 above.

- ERR119: File "<filename>" is not a valid Decode Net file.

The given filename is not of type D. Use the DIR command to make sure that a file of type D of the given name exists. If the file does not exist, use a copy of the floppy disk that does. If the file does exist, try replacing the floppy disk, and then issue the BOOTP command. Contact Customer Service if the error persists.

- ERR120: File "<filename>" is not a valid Microcode file.

The filename given in a Diagnostic Processor command is not valid. Use the DIR command to make sure that the corresponding file is of type "M". If it is not, the command cannot be run with this file type. If it is, perform a Master Clear operation, and issue the command again. Contact Customer Service if the command still fails.

- ERR121: File "<filename>" is not a valid PMA file.

The filename given in a Diagnostic Processor command is not valid. Use the DIR command to make sure the filename corresponds to a file of type "T". If it does not, the command cannot be used. If it does, perform a Master Clear and issue the command again. Contact Customer Service if the command still fails.

- ERR130: Recoverable Verification error on file "<filename>"

A file verification error is detected and is successfully corrected when the Diagnostic Processor retries the operation one more time. This condition is an indication of "soft" disk error and other transient hardware failures. Use a new floppy disk. If condition persists, contact Customer Service.

- ERR131: Verification error on file "<filename>"

The Diagnostic Processor detects Control Store microcode discrepancies when verifying microcode. Contact Customer Service.

- ERR200: Disk read error on file "<filename>"

This error indicates that the information on the floppy disk on the particular file indicated has gone bad. Replace with a floppy disk that is known to be good. If the error persists, contact Customer Service.

- ERR201: Floppy Disk read error on directory sector.

The Diagnostic Processor was unable to read the directory information from the floppy disk. Make sure a valid disk is inserted and the door to the drive is closed. Issue a DIR :0 command, as doing this may solve the problem. If the error persists, replace the floppy disk media, and if all else fails contact Customer Service.

- ERR202: Unable to determine Central Processor System type.

The Diagnostic Processor is unable to determine the type of Processor. Contact Customer Service.

- ERR205: Incorrect password entered.

The password entered is not the correct one. This message will appear any time the remote port is enabled. The remote password can be set from the local supervisor terminal only. The prompt requesting the password issued to the remote port cannot be exited by typing CONTROL-P. The password will be prompted for a maximum of three times after which the Diagnostic Processor will disconnect the remote port. Contact the local operator for the correct password.

- ERR300: CPU not responding during loading of Microcode.

The Diagnostic Processor and the CPU are not communicating during the microcode load sequence. Contact Customer Service.

- ERR301: CPU not responding.

The CPU is not responding to a Diagnostic Processor command. Retry the command. If it still fails, initiate the autoboot sequence using the BOOTP or BOOTD command. If this doesn't solve the problem, contact Customer Service.

- ERR304: Diagnostic Processor CPU Verification error.
Control Store Address: <hhhh>

The Diagnostic Processor detected a CPU Control Store error at Hexadecimal location <hhhh>. Contact Customer Service.

- ERR306: Attempt to resynchronize failed.

The CPU is not responding correctly to the Diagnostic Processor request to resynchronize. This occurs whenever a command from the Diagnostic Processor times out on waiting for a reply from the CPU or if the command is not not acknowledged (NACKed) by the CPU. It will also occur if an unexpected character is received from the CPU by the Diagnostic Processor or if the Diagnostic Processor detects either a framing or parity error on the CPU link. Contact Customer Service if the error persists.

- ERR307: CPU Interface verification error.

This indicates that the Diagnostic Processor/CPU interface failed while loading microcode. Contact Customer Service.

- ERR308: Verification error on Decode Net file "<filename>"

The Decode net verification operation fails. Make sure that the loaded Decode net is the same as the verified Decode net. Contact Customer Service.

- ERR309: CPU Pipeline Synchronization failure.
Most probable replaceable unit is <orul>
Second most probable replaceable unit is <oru2>

The Diagnostic Processor detected the hardware signal PCUFAIL- going active after issuing a SYSCLR command. The most probable failing units are displayed. Contact Customer Service.

- ERR311: Diagnostic Processor CPU communication error.

During an Autoboot sequence, the Diagnostic Processor test of the CPU communications link failed. Contact Customer Service.

- ERR312: Diagnostic Processor CPU communication error.

During an Autoboot sequence, the Diagnostic Processor detected a failure to communicate with the CPU after the initial test passed. This error is reported while the Diagnostic Processor is writing test patterns to the Loadable Control Store. Contact Customer Service.

- ERR313: Diagnostic Processor CPU communication error.

During an Autoboot sequence, the Diagnostic Processor detected a failure to communicate with the CPU after the initial test passed. This error is reported while the Diagnostic Processor is reading test patterns out of the Loadable Control Store. Contact Customer Service.

- ERR375: Verification error on file "<filename>", Word <nnnn>
Data expected (in hexadecimal) : HHHH HHHH HHHH HHHH HHHH
Data found (in hexadecimal) : HHHH HHHH HHHH HHHH HHHH

The Diagnostic Processor detects Control Store microcode discrepancies when verifying microcode. Contact Customer Service.

- ERR400: Diagnostic Processor detects cabinet overtemperature.

The cabinet temperature has risen above the allowable operating level. The Diagnostic Processor has signaled PRIMOS with a processor check so that an orderly shutdown may be attempted before the temperature rises beyond a critical level. The computer room temperature should be checked to make sure that it falls within the specified levels. Once the temperature falls to a normal level, the system can be brought up again. If this error occurs and the temperature in the computer room is definitely within the allowable limits, contact Customer Service.

- ERR401: Diagnostic Processor detects insufficient air flow.

The blower assembly is not providing adequate air flow to cool the CPU. PRIMOS will attempt to shut down in an orderly fashion before the CPU reaches a critical temperature. Contact Customer Service.

- ERR402: Diagnostic Processor detects UPS low battery condition.

This message can only occur when the complete system including all peripherals is powered by an Uninterruptible Power Supply (UPS) system. It indicates that the batteries that supply the backup power to the system are about to go dead. A Check condition is sent to PRIMOS so an orderly shutdown may be attempted before the batteries die. If this message occurs at a time other than during a power outage, contact Customer Service.

- ERR403: Diagnostic Processor detects processor overtemperature.

The CPU reached a critical temperature. The Diagnostic Processor will shut down the system power immediately to prevent damage to the hardware. Contact Customer Service.

- ERR500: Diagnostic Processor Disk identification error.

Disk needed for processor: <type1>

Part number: xxxx-xxx - Rev a

Part number: xxxx-xxx - Rev a

.

.

.

Part number: xxxx-xxx - Rev a

Disk inserted is for processor: <type2>

Part number: yyyy-yyy - Rev b

Part number: yyyy-yyy - Rev b

.

.

.

Part number: yyyy-yyy - Rev b

The wrong floppy disk media was inserted into the disk drive. A valid floppy disk for processor type <type2> with the correct revisions and part numbers must be inserted.

- ERR600: Bad Syntax [<last token>]

The last line typed contained bad syntax or incorrect arguments. The input that caused the error is displayed as the "<last token>". If an argument was missing then the <last token> would be "null" and would be displayed as "[]".

- ERR800: Diagnostic Processor time of day clock not valid.

The diagnostic processor's time of day clock is not working correctly. This may occur if it has not been initialized properly. Use the SETIME command to correctly set the time and date. If this error persists, contact Customer Service.

- ERR900: Command not acknowledged.

The CPU does not acknowledge a Diagnostic Processor command. This might happen when a parity or framing error occurs and should always recover when the Diagnostic Processor attempts resynchronization. If the condition persists, contact Customer Service.

- **ERR901: Unexpected character received from CPU.**

The CPU is sending data that the Diagnostic Processor is not expecting. Contact Customer Service.

- **ERR903: Invalid input (token too big).**

The command entered has more characters than the Diagnostic Processor can handle. Check the command syntax and issue the correct command.

C

Remote Diagnostics

INTRODUCTION

The Prime 9950 allows the operator to permit a remote user to perform system test and maintenance operations. The remote user is normally a Customer Service Representative. The operator enables remote diagnostics and tells the remote user the remote password for the system. The remote user then makes contact with the CPU by calling the modem. During the remote user session, the local operator can observe what the remote user types and can also allow the remote user to actually change the state of the system.

This appendix discusses remote diagnostics from both the local operator's and remote user's points of view. The local operator is concerned with enabling and disabling remote diagnostics. The remote user is concerned with establishing contact with the Diagnostic Processor as a remote user.

ENABLING REMOTE DIAGNOSTICS

There are three aspects to enabling remote diagnostics:

- Enabling the remote port of the Diagnostic Processor
- Setting the remote password
- Turning control of the Diagnostic Processor over to the remote user (optional)

Enabling the Remote Port

The remote user will establish contact with the Diagnostic Processor by dialing up a modem connected to the remote port of the Diagnostic Processor. However, before the connection is accepted by the Diagnostic Processor, the remote port must be enabled.

To enable the remote port, press the REMOTE ENABLE button on the system status panel. The light labeled REMOTE will glow.

This allows any call into the modem connected to the remote port to be accepted by the Diagnostic Processor.

Setting the Remote Password

If the remote password has not already been set, set the remote password by placing the Diagnostic Processor in Control Panel mode and issuing the REMPWD command. The Diagnostic Processor will prompt you for the remote password. Enter the remote password. It will not be echoed on the supervisor terminal. For example:

OK, <ESCAPE><ESCAPE>

CP> REMPWD

Enter remote password: BABEL (not echoed)

CP>

This not only sets the remote password for the following remote session, but sets the password for all remote sessions on that particular Diagnostic Processor. The remote password is remembered even across power failures, as it is preserved in involatile memory. To change the password, issue the REMPWD command again.

Once the remote password has been set, notify the remote user of the password over the phone. The remote user will then dial up the Diagnostic Processor. When contact is made, the light labeled REMOTE ACTIVE will glow.

At this point, you are still in full control of the system, but the remote user sees everything that is typed on the supervisor terminal at his or her terminal. Similarly, anything typed by the remote user will be echoed on the supervisor terminal, but it will be enclosed in angle brackets and will not otherwise affect the behavior of the Diagnostic Processor. This allows you to communicate with the remote user.

Turning Control Over to the Remote User

Once communication has been established and you have verified that the remote user is indeed the correct person, you may wish to allow the remote user complete control of the Diagnostic Processor and the CPU.

To do this, press the REMOTE PRIVILEGE button. When you do this, the light labeled REMOTE ACTIVE will blink on and off. In addition, the CP> prompt issued by the Diagnostic Processor will be changed to CP*> to indicate that the remote user has control of the Diagnostic Processor (the remote user is privileged).

While the remote user has control, you will see all interaction performed between the remote user and the Diagnostic Processor on the supervisor terminal. You may type on the supervisor terminal and the remote user will see what you type. However, whatever you type will be enclosed in angle brackets, and it will not affect the Diagnostic Processor until you again press REMOTE PRIVILEGE to return control of the Diagnostic Processor to the supervisor terminal.

DISABLING REMOTE DIAGNOSTICS

When the remote user has completed his or her session, press the REMOTE ENABLE button to disconnect the remote user and disable the remote port. If you had pressed the REMOTE PRIVILEGE button earlier, press it again to deny the remote port control of the Diagnostic Processor.

PERFORMING REMOTE DIAGNOSTICS

This section is for a Customer Service Representative who is connecting to the Diagnostic Processor of a Prime 9950 as a remote user. After determining the phone number of the modem connected to the remote port of the Diagnostic Processor and asking the operator for the remote password, dial up the remote port.

When the Diagnostic Processor detects that the remote terminal is connected, it will prompt you for the remote password. The prompt will appear as follows:

DPM202: Please enter remote password:

If the wrong password is entered, the Diagnostic Processor will print the message:

ERR205: Incorrect password entered.

If the correct password is not entered after three tries or before 40 seconds elapse, the Diagnostic Processor will disconnect the remote terminal.

Once the correct password is entered, you will be able to monitor Diagnostic Processor commands issued from the local supervisor terminal. Any commands you type at this point will be echoed with surrounding angle brackets at the local supervisor terminal. However, these commands will not be executed until the local operator presses the REMOTE PRIVILEGE button on the system status panel.

In order for you to have the ability to execute commands that would change the state of the system, the REMOTE PRIVILEGE button on the system status panel must be pressed. While the remote port is privileged, the prompt CP*> will be used in lieu of the CP> prompt. Any commands typed on the supervisor terminal will then be bracketed by angle brackets and will not be executed.

D

Using the Control Panel

INTRODUCTION

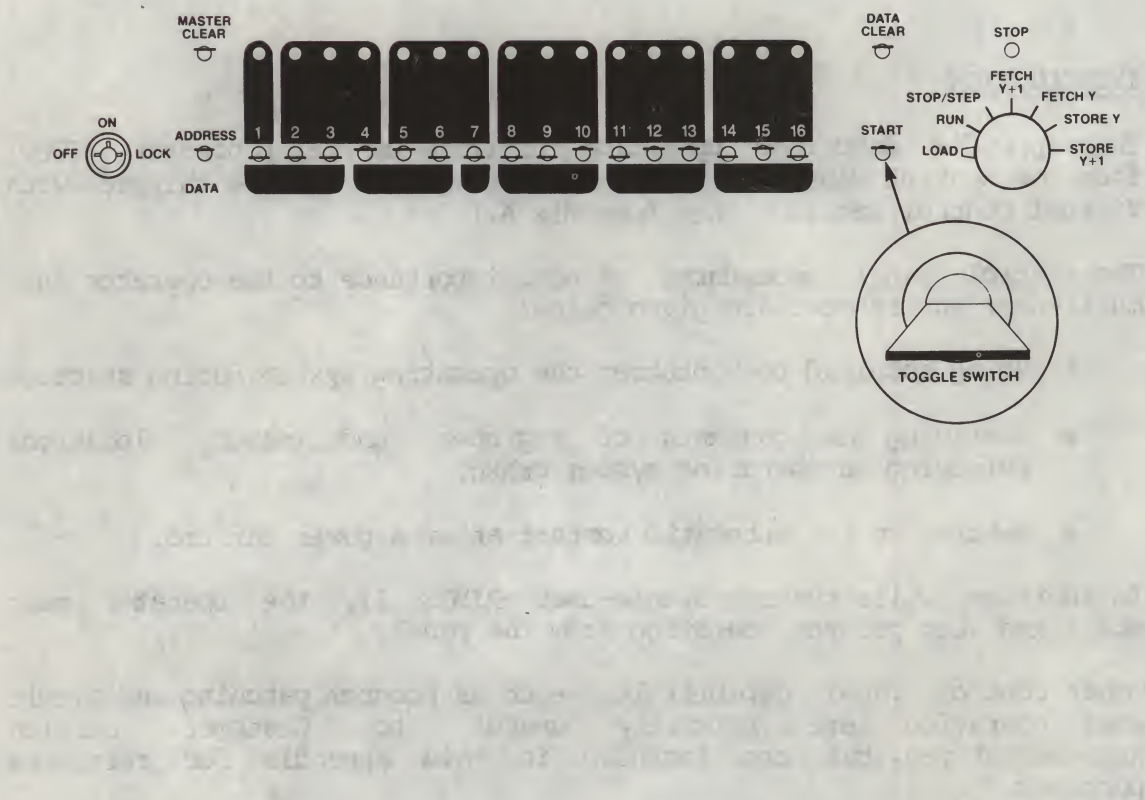
This appendix describes operation of Prime central processors (CPUs) from the Control Panel (CP). All Prime computers are now shipped with Virtual Control Panels. (See Appendix A.)

The control panel procedures of most importance to the operator in a multi-user environment are given below:

- Using autoloader to bootstrap the operating system during startup.
- Examining the contents of register and memory locations following an operating system crash.
- Setting up for automatic restart after a power failure.

In addition, while running single-user PRIMOS II, the operator must start and stop program operation from the panel.

Other control panel capabilities such as program patching and single step operation are primarily useful to Customer Service Representatives, but are included in this appendix for reference purposes.



Prime Control Panel Switches and Indicators
Figure D-1

CONTROL PANEL FEATURES

All Prime control panels have the same physical switch and indicator layout. See Figure D-1 on the facing page. In general, operation of all panels is identical, except that the Prime 350 and above have additional capabilities to permit the following:

- Accessing register sets
- Addressing physical memory using a full 22-bit address
- Addressing mapped memory when segmentation is enabled

These advanced features are enabled by sense-switch settings that have no effect in the Prime 300 and below.

RUN FUNCTIONS

RUN mode is the normal control panel state for execution of programs. In RUN mode, the control panel has no effect on processor operation, but the 16 sense switches and indicators act as programmed input/output devices. A hardware register in the panel controls the indicators; it can be loaded with data from the A-register by an OTA instruction. The sense switches can be read into the A-register by an INA instruction, or can be tested by SKS instructions.

Data transferred to the indicator register from the CPU is displayed when the ADDRESS/DATA switch is in the DATA position. In the ADDRESS position, the indicators present a dynamic display of whatever is present in the CPU's BMA (memory address) bus.

Single Step Functions

Immediately after power-up or whenever the rotary switch is turned to STOP/STEP, the CPU is halted (STOP light is on) and the control switches on the panel enable the operator to access, modify, or execute single 16-bit cells of high-speed memory, including the register files.

Access (FETCH): The memory cell specified by the indicator display when the ADDRESS/DATA switch is at ADDRESS is accessed by turning to FETCH and pressing START. The content of the cell is then displayed by the indicators when the ADDRESS/DATA switch is at DATA.

Modify (STORE): The contents of the addressed memory cell can be modified by setting up a new data display, turning to STORE, and pressing START.

Consecutive FETCH or STORE: The FETCH Y+1 and STORE Y+1 functions permit accessing or modifying of consecutive memory locations. The address is incremented by 1 automatically when the START switch is pressed before the operation is carried out.

Single-Step Execution: While the rotary switch is in STOP/STEP, each operation of the START switch executes the instruction designated by the contents of the P-register, memory location 7. All levels of indirect addressing and indexing are carried out, and the instruction is executed. The address of the next instruction to be executed is loaded into the P-register and displayed on the indicators if ADDRESS/DATA is at ADDRESS. After executing each instruction, the operator can FETCH or STORE other registers or memory locations. When the ADDRESS/DATA switch is at DATA, the indicators display the data or instruction in the last accessed location.

LOAD Functions

The LOAD position of the rotary switch enables Automatic Program Load (APL), which simplifies program loading and permits automatic restart or reload after a power failure.

Other Features

Master Clear: The MASTER CLEAR switch, operative in all rotary switch positions except LOAD and RUN, places the CPU and all peripheral controllers in a known starting condition.

STOP Lamp: The STOP lamp lights when the CPU is in a halt condition from either a panel halt or execution of the HLT instruction.

Battery Backup Indication: The STOP lamp flashes on and off if there has been a power failure and the memory is being refreshed by the backup battery pack (optional).

Keyswitch: A rotary keyswitch provides line power on/off control and a lockout position that disables the control panel except for sense switch settings and indicator displays controlled by the running program.

CONTROL AND INDICATOR FUNCTIONS

Functions of the Prime control panel switches and indicators are described in Table D-1.

Table D-1
Control Panel Functions

Item	Function
Keyswitch	Power control and panel locking rotary keyswitch.
<u>Position</u>	
OFF	Line power is removed from Prime CPU; the power supply and battery backup are inactive.
ON	Line power is applied to the Prime CPU power supply, and the control panel rotary switch determines CPU mode of operation.
LOCK	Same as ON, but control panel rotary switch has no effect on CPU run condition. (Data switches and indicators can be accessed by programmed I/O, however, and the ADDRESS/DATA switch functions normally.)
MASTER CLEAR Switch	Momentary-down switch sets CPU registers and status to known starting condition (see the earlier section on Master Clear).
Address/Data Indicators	What these indicators display depends on the position of the rotary mode switch, the ADDRESS/DATA switch, and the last operation that took place.
Rotary Switch	
<u>Position</u>	<u>ADDRESS/DATA Switch Position</u>
	<u>Address</u> <u>Data</u>
RUN or LOAD	Contents of CPU's BMA (address) bus Content of panel's indicator register (loaded by OTA '1720)

Table D-1 (continued)
Control Panel Functions

STOP/STEP	<u>After LOAD, RUN, or single step execution</u>	
	Address of next instruction to be executed, same as contents of P-register (location 7)	Contents of next instruction location
	<u>After FETCH or STORE operation</u>	
	Same as FETCH or STORE	Same as FETCH or STORE
FETCH Y or STORE Y	Address of next cell to be accessed	Data last set up by data switches, or FETCH or STORE
FETCH Y+1 or STORE Y+1	One less than address of next cell to be accessed (address is incremented before FETCH or STORE takes place)	Same as FETCH or STORE
DATA CLEAR Switch	Momentary-down switch clears address or data display (selected by ADDRESS/DATA switch).	
STOP Indicator	Lights when CPU is halted either from programmed HLT instruction or panel halt (rotary switch in any position except RUN or LOAD).	
Mode control rotary switch	Seven-position rotary switch controls Prime CPU mode of operation. Active only when keyswitch is at ON.	
	<u>Position</u>	<u>Description</u>
	LOAD	Enables automatic program load sequence, a CPU option that takes the place of a key-in loader and permits automatic hardware read-in of programs from various media. Also implements automatic reload or restart after a power failure, and CPU restart at address in sense switches.

Table D-1 (continued)
Control Panel Functions

<u>Position</u>	<u>Description</u>
RUN	Normal operating state of CPU; after START switch is operated, clock runs and CPU executes sequential instructions.
STOP/STEP	Stops CPU and permits address/data changes, Master Clear, and single-step execution. Interrupt and DMX operations are disabled.
STORE Y	When START switch is depressed, content of data display is stored in register or memory location specified by address display. The address and data displays are unaltered.
FETCH Y	When START switch is depressed, content of register or memory location (specified by address display) is displayed on indicators.
FETCH Y+1	Same as FETCH, but address display is incremented by 1 before location is read. Each operation of START switch accesses the next sequential memory location for display.
STORE Y+1	Same as STORE, but address display is incremented by 1 before location is loaded. To load sequential locations, leave ADDRESS/DATA switch at DATA, enter each new data value in data switches, and press START. Next memory address is set up automatically.

Table D-1 (continued)
Control Panel Functions

START Switch	Initiates operation set up by rotary switch (RUN, LOAD, FETCH, STORE).
Data Entry Sense Switches	Bank of 16 toggle switches. (UP = latching; DOWN = center; SET = momentary.) Momentary SET position of any switch sets a 1 into corresponding position of indicator display (address or data, depending on position of ADDRESS/DATA switch).
<u>Note</u>	
In RUN mode, momentaries can be program tested by INA '1720.	
Center DOWN and latching UP position provide sense switch data to INA '1620 and sense switch skip instructions (SNS, etc.). These positions provide device identification for bootstrap LOAD operation. UP is 1 and DOWN is 0 for each switch. Switches 1 to 16 correspond to A-register bits 1 to 16.	
For P350-400-500, the sense switches also make it possible to examine locations in the general register sets and to specify 22-bit absolute addresses or segment addresses. (See Table D-2.)	

SUMMARY OF OPERATING PROCEDURES

The following procedures apply to all CPUs unless otherwise specified. The various Prime systems are sometimes abbreviated with the letter P and the system number, such as P100 and P400.

Turning Power On

1. If automatic program load is desired, turn rotary switch to LOAD. If not, select STOP/STEP.
2. Turn CPU keyswitch ON. The blowers must begin operating. A MASTER CLEAR sequence occurs, and an automatic program load takes place, if the option is present and the device is ready.
3. On the paper tape unit (if present), press the POWER switch; the internal indicator should light and the fans should begin operating.
4. Turn the supervisor terminal LINE/OFF/LOCAL switch to LINE.
5. Refer to the appropriate vendor manuals for turn-on procedures of other peripheral devices.

Master Clear

The MASTER CLEAR switch places the Prime CPU in a known starting condition:

- Except for the P-register, all registers in the register files (memory locations 0-'37 for the Prime 100-200-300) are cleared (set to all 0s).
- The P-register is set to '001000 (the starting address of most self-loading programs, and the restart address of most system programs).
- The CPU is set up in 16K sector addressing mode and single precision arithmetic mode, with interrupt and machine check inhibited and standard interrupt mode in effect.
- All peripheral controllers are initialized.
- Micro-verification takes place if the CPU contains the microverify feature.

MASTER CLEAR operates in any position of the mode control rotary switch except LOAD or RUN.

Table D-2
Register and Memory Access in the Prime 350, 400, and 500

Sense Switch	Register Access		Memory Access	
SS1	UP		DOWN	
SS2	UP:	Bits 10-16 of address register specify the four 32-bit register sets: '0-'37 CPU scratch (RF0) '40-'77 DMA (RF1) '100-'137 User Set (RF2) '140-'177 User Set (RF3)	Not used	
	DOWN:	Bits 12-16 of address register specify the location in the current register set (CRS)		
SS4	UP:	Address high-order half of 32-bit register	UP:	Absolute addressing of physical memory.
	DOWN:	Address low-order half of 32-bit register	DOWN:	Mapped addressing of segmented memory (if segmentation is enabled). Set segment number in SS5-16

Setting Address Display

Before a series of register or memory FETCH or STORE operations, the memory address must be set to a starting value using the panel data entry switches. The rotary switch can be in any position except RUN or LOAD.

1. Set the ADDRESS/DATA switch to ADDRESS.
2. Clear the address display by pressing the DATA CLEAR switch. The indicators will go out. Set the desired address by pressing the momentary-action data entry keyswitches. If you make a mistake, clear the display by pressing DATA CLEAR and try again.

Setting Data Display

Data to be stored in a memory location is first set into the DATA display from the panel data entry switches. The rotary switch can be in any position except RUN or LOAD.

1. Set the ADDRESS/DATA switch to DATA.
2. Clear the display by pressing the DATA CLEAR switch. Set the desired value by pressing the momentary-action data entry switches. If you make a mistake, clear the display and try again.

Examining Registers and Memory Locations (P100-200-300)

The Prime 100, 200, and 300 computers only use the procedures below.

1. Set the address display to the first location to be examined. Return ADDRESS/DATA switch to DATA position. Turn to FETCH and press START. The contents of the register (or location) will appear in the indicators. (See Table D-3 for a map of registers and reserved memory locations.)
2. To examine successive locations, turn to FETCH Y+1. Every time START is pressed, the address register is incremented before the location is read. The indicators display the contents of successive locations after each depression of the START switch.

Table D-3
Reserved Memory Locations in the Prime 100, 200, and 300

Address	Assignment
'000000	X-Register - Index Register
01	A-Register - Arithmetic, Shift, I/O
02	B-Register - Ext. Arithmetic, Shift
03	Stack Pointer
04	FLPH - Floating Point High (optional)
05	FLPL - Floating Point Low (optional)
06	VSC - Visible Shift Counter
07	P-Register - Program Counter
10	PMAR - Page Map Address Register (optional)
11	Microcode Scratch Location
12	EAS - Effective Address Save (ILL, UII, Interrupts, etc.)
13	Microcode Scratch Location
14	Y-Register Save for Control Panel DMA
15	M-Register Save for Control Panel DMA
16	Microcode Scratch Location
17	Microcode Scratch Location
20-37	DMA Range/Start Address Pairs
40-57	Reserved for DMC Channel Pairs
60	PFI - Power Failure Interrupt
61	RTCI - Real Time Clock Increment (optional)
62	REVI - Restricted Execution Violation (optional)
63	INT - Standard Interrupt (Compatible Mode)
64	Page Fault - Addressed Page Not in Mem. (optional)
65	SVC - Supervisor Call Trap
66	UII - Unimplemented Instruction Interrupt
67	PE - Memory Data Parity Error
70	Machine Check - Processor Detected Error
71	Missing Module - No memory at Accessed Location
72	ILL - Illegal Instruction Interrupt
73	PWV - Page Write Violation (optional)
74	FLEX - Floating Point Exception (optional)
75	PSU - Procedure Stack Underflow (PRIME 300 only)
76-100	Debugging Scratch Area
101-177	Interrupt Vectors
200-777	General Cross Sector Links

Loading Registers or Memory Locations (P100-200-300)

The Prime 100, 200, and 300 computers use these procedures:

1. Set the address display to the first location to be altered. Then, set the data display to the desired content and turn to STORE. Press START. The content of the data register will be loaded into the location. The indicators can display either data or the address, depending on the position of the DATA/ADDRESS switch.
2. To load sequential locations, turn to STORE Y+1. Every time START is pressed, the address display is incremented before the location is loaded. Therefore, by repeatedly loading a new value into the data register and pressing START, sequential locations are loaded.

Accessing Physical Memory (P350 and up)

For all Prime computers except the Prime 100, 200, and 300, setting sense switch 1 (SS1) down when accessing locations specifies that memory is to be accessed. When segmentation is not enabled, or when sense switch 4 (SS4) is up, the control panel accesses physical memory. Sense switches 11-16 provide the high-order bits of a full 22-bit physical address. Locations 0-'37 are the Prime 100-200-300 registers listed in Table D-3. While in V- or I-mode, with segmentation enabled, only locations 0-7 are the Prime 100-200-300 registers.

1. To do a STORE operation, set the 16-bit data value in the DATA display.
2. Set low-order 16 bits of address in ADDRESS display.
3. Set high-order 6 bits of address in SS11-16.
4. Set SS1 down and SS4 up.
5. Set rotary switch to desired function and press START for access.

Accessing Mapped Memory (P350 and up)

For all Prime computers except the Prime 100, 200, and 300, if segmentation is enabled, and SS4 is down, memory accesses are mapped. The segment number is set in SS5-16. Locations 0-'17 are specific Prime 350-400-500 register values as shown in the second column of Table D-4.

1. If this is to be a STORE operation, set the 16-bit data value in the DATA display.
2. Set address of word within segment in ADDRESS display.
3. Set segment number in SS5-16.
4. Set SS1 and SS4 down.
5. Set rotary switch to desired function and press START for access.

Note

If the addressed page is not currently in physical memory, the DATA indicator display is unpredictable.

Accessing Prime 350-400-500 Registers (Absolute Addressing)

With SS1 and SS2 up, any location in any register set can be accessed by an absolute address for all Prime computers except the Prime 100, 200, and 300:

'0 - '37	Microcode scratch
'40 - '77	DMA
'100 - '137	User Set 2
'140 - '177	User Set 3

The Y+1 functions increment the register address before the access. The address overflows from '177 to 0 as higher-order bits are ignored.

1. If this is to be a STORE operation, set the 16-bit data value in the DATA display.
2. Place SS1 and SS2 up.
3. Set absolute address of desired register location in bits 10-16 of the ADDRESS display. Bits 10 and 11 specify the register set, bits 12-16 specify the register number.
4. Set SS4 to select the register half to be accessed: UP = high, DOWN = low.
5. Set rotary switch to desired function and press START for access.

Table D-4
Prime CPU Register Correspondence

P350-400-500 Register Location	P100-200-300 Register Location	Register Contents
2H	7	P (program counter)
2L	1	A (accumulator)
	2	B (double-precision and long accumulator extension)
3 H,L	-	EH,EL (accumulator extension for MPL,DVL)
5 H	3	S (stack), Y (alternate index)
7 H	0	X (index)
10 H	13	-
10,11	-	FAR0,FLR0 (field address and length register 0)
12,13	-	FAR1,FLR1 (field address and length register 1)
12 H	4	FAC (floating accumulator, mantissa high)
12 L	5	FAC (mantissa middle)
13 H	6	FAC (exponent)
13 L	-	FAC (mantissa low, double-precision)
14 H,L	-	PB (procedure base)
15 H,L	14,15	SB (stack base)
16 H,L	16,17	LB (linkage base)
17 H,L	-	XB (temporary base)
20 H	10	(High half of DTAR3)
20 H,L	-	DTAR3 (descriptor table address segments 3072-4095)
21 H,L	-	DTAR2 (segments 2048-3071)
22 H,L	-	DTAR1 (segments 1024-2047)
23 H,L	-	DTAR0 (segments 0-1023)
24 H,L	-	Keys, modals
25 H,L	-	OWNER (address of process control block of process owning register contents)
26 H	11	FCODE (fault code)
27 H,L	-	FADDR (fault address)
27 L	12	(Fault address word number)
30 H	-	Process 1024-microsecond CPU timer

Note

1. In mapped access for P350-400-500, the P100-200-300 register contents are accessed as shown in the second column.
2. H means high-order half of 32-bit register. L means low-order half.

Accessing Prime 350-400-500 Current Register Set (CRS)

With SS1 up and SS2 down, the current register set is accessed by addresses '0 through '37 for all Prime computers except the Prime 100, 200, and 300. The first column of Table D-4 shows the contents of the CRS. For Y+1 functions, the address is incremented before the address overflows from '37 to 0.

1. If this is to be a STORE operation, set the 16-bit data value in the DATA display.
2. Place SS1 up and SS2 down.
3. Set address of desired location in CRS in bits 12-16 of the ADDRESS display.
4. Set SS4 to select the register half to be accessed: UP = high, DOWN = low.

Single Step Operation

1. Turn to STOP/STEP. The address display shows the address of the next instruction to be executed. (The data display is the instruction itself.) To begin single stepping at another location, STORE a new address in the P-register.
2. Press START. The current instruction is executed and the address of the next instruction is formed. (The next address is normally P+1, but may be P+2 after a skip or a two-word instruction or the jump destination after a jump instruction.)
3. Registers or memory locations can be examined or altered using the FETCH and STORE functions. When the rotary switch is returned to STOP/STEP, the CPU is ready to execute at the current program count in the P-register, even though the address display may contain the address used for the last FETCH or STORE cycle. After the next operation of the START switch, however, the address display is updated to show the program count again.
4. Interrupt and DMX operations are disabled in STOP/STEP mode.

Starting a Program

Note

Also see the section Automatic Program Load for alternate ways to start execution.

1. Turn the rotary switch to any position except RUN or LOAD. If the machine needs to be initialized, press MASTER CLEAR.
2. Load the P-register with the desired starting address, obtained from the listing, the paper tape label, or other documentation. (A MASTER CLEAR leaves the P-register set to '1000, the starting location of most Prime system software.)
3. Determine whether other registers or memory locations must also be preset to starting values. (See Table D-4.)
4. Turn to RUN and press START. The program should begin running (STOP indicator goes out). Panel switches and indicators are then accessible to programmed I/O instructions only.

Recovering From Errors

If an equipment failure or program error causes the CPU to leave PRIMOS II control, it is usually possible to restart the CPU from the control panel. The procedure is as follows:

1. Turn the rotary switch to STOP/STEP; press MASTER CLEAR.
2. Set the sense switches to the restart address.
3. Turn rotary switch to LOAD; press START.
4. Reset sense switches to 0.

Panel Lockout

Turn the keyswitch to the LOCK position. The CPU is then insensitive to the position of the rotary switch, and the running program cannot be stopped from the panel. (The sense switches and indicators are still accessible to programmed I/O instructions, however.)

Stopping Execution

1. To stop program execution, turn panel lockout keyswitch to ON and turn rotary switch to STOP/STEP. (STOP indicator should light.) Memory and registers can be examined or altered and a new starting address can be set.
2. To continue execution, turn rotary switch to RUN and press START. Lock panel if desired.

AUTOMATIC PROGRAM LOAD

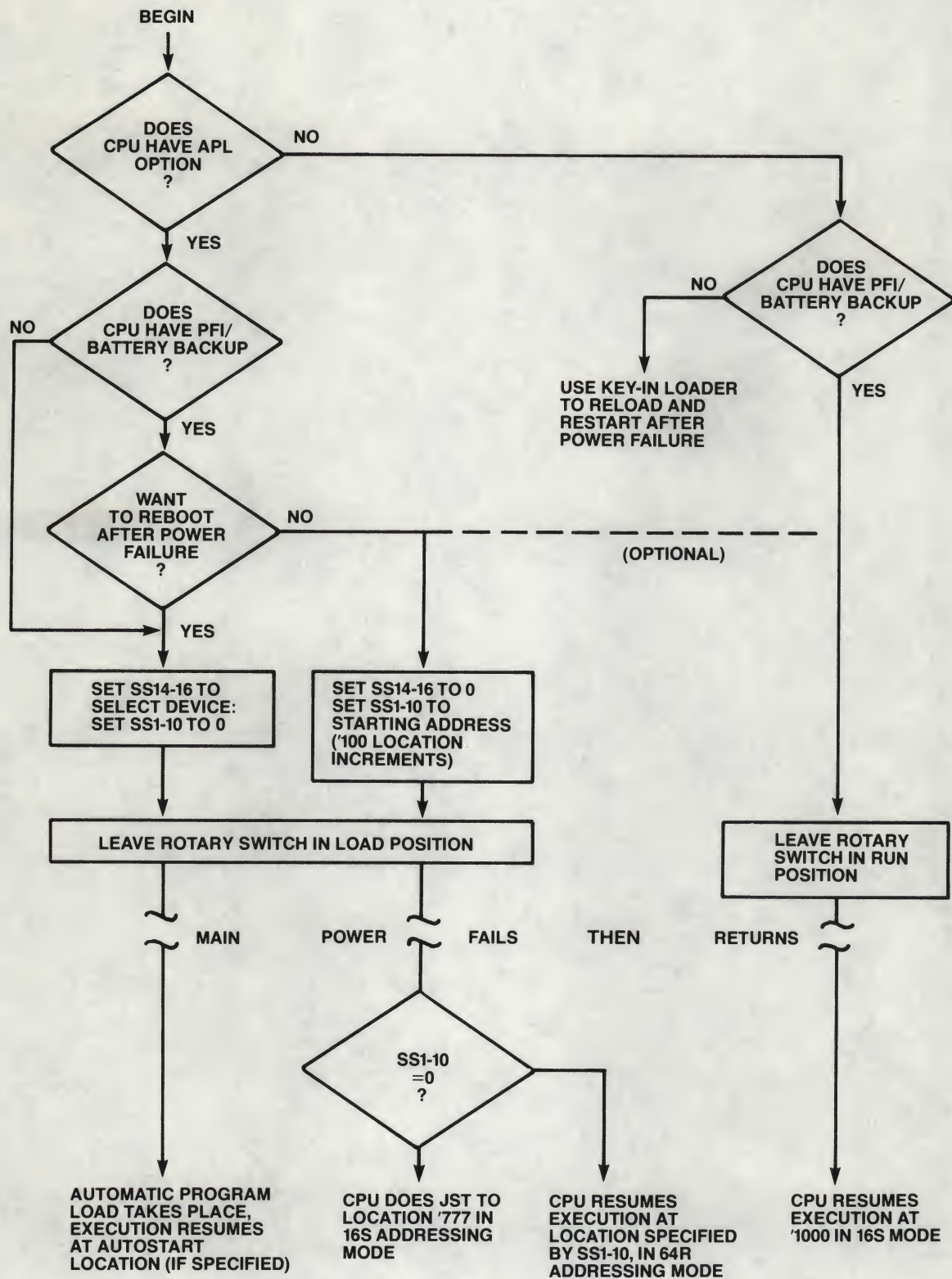
The Automatic Program Load (APL) feature of Prime CPUs simplifies loading of programs and operating systems from external storage devices. Operating procedures are described briefly below. See Chapter 19 for standard disk boot instructions, and Appendix E for standard tape boot instructions. Appendix E also explains the various sense switch settings used during boots.

1. Install on the appropriate device the medium from which a program is to be loaded. Make sure power is on and both the device and the supervisor terminal are ready to operate.
2. Set the sense switches as explained in Appendix E.
3. Press MASTER CLEAR.
4. Turn rotary switch to LOAD and press START. If bootstrapping is successful, a message will appear on the supervisor terminal.

AUTOMATIC RESTART OR REBOOT AFTER POWER FAILURE

Once a program has been loaded and started, the CPU is capable of an automatic restart or reload after a power failure. There are four possible methods, depending on whether the CPU contains the APL or battery backup/PFI features. Figure D-2 summarizes the panel setup required to prepare the CPU for a Restart/Reboot sequence.

When a reboot is desired, the autoloader device must be ready to operate. If paper tape is used, it must be repositioned to the beginning of tape. (The tape must have an auto-start address.)



Panel Setup for Automatic Restart or Reload After Power Failure

Figure D-2



Approved for release by NSA on 08-25-2014 pursuant to E.O. 13526

E

Bootstraps

INTRODUCTION

The chapter on system startup for each CPU contains instructions for performing a standard PRIMOS boot from disk. This appendix supplies the following information on booting the system:

- Boot PRIMOS II and utilities from magnetic tape (for example, if your system disk pack crashes or fails to boot)
- Boot PRIMOS or PRIMOS II from a disk that is not Drive Unit 0 on Controller 0
- Generate a magnetic tape that can be used in emergency situations to boot the system (used when booting PRIMOS II from magnetic tape)
- Interpret an error code that appears in the control panel data lights or at the supervisor terminal during a boot

A reference section is also provided at the end of this appendix. This section describes the following:

- Initiating the pre-boot; the octal parameters and their meanings
- The BOOT program on disks
- The MTBOOT program on magnetic tapes

BOOTING PRIMOS II AND UTILITIES FROM MAGNETIC TAPE

If there are no available disks from which to boot PRIMOS II on your system, you will have to boot PRIMOS II from magnetic tape. You must have a tape that contains the magnetic tape boot program, a copy of PRIMOS II (DOS>*DOS64), and a copy of each utility that you intend to use (such as MAKE and MAGRST).

A boot tape is generated using the `BOOT_CREATE` command. The use of this command to generate a boot tape is described later in this appendix. Complete information on the `BOOT_CREATE` command is found in Volume II of this book.

19.2 A boot tape may also be generated using the `MAGSAV` command. However, the `BOOT_CREATE` command is preferred. If you do not have a boot tape that was generated using `BOOT_CREATE`, you may use a boot tape generated using `MAGSAV`. The procedure for booting a system from a tape generated by the `BOOT_CREATE` command will also work when booting a system from a tape generated by `MAGSAV`.

The purpose of booting PRIMOS II from tape is usually to restore a system disk to an earlier state. Once the disk is restored, PRIMOS may then be booted from disk in the usual fashion. Utility commands such as `MAKE` and `MAGRST` are used to restore the disk. Procedures to restore the system disk from tape are described in detail in Volume II of this book.

The procedure from booting a system from tape requires some interaction with the Virtual Control Panel (VCP) or Control Panel (CP) on your system. Therefore, the procedure is described twice in the two following sections.

The first section describes the procedure for booting PRIMOS II and utilities from tape on a system that has a VCP or a Diagnostic Processor. The Diagnostic Processors on the Prime 9950 and 2250 provide the functionality of a VCP. Although the appearance of the output of the 50-Series VCP, 2250 Diagnostic Processor, and 9950 Diagnostic Processor differ, this procedure only uses commands that produce the same effect on all three systems.

The second section describes the procedure for booting PRIMOS II and utilities from tape on a Prime 350, 400, or 500. These systems use a Control Panel (CP) instead of a VCP.

Bootting From Tape on a Computer With a VCP

Use the following procedure to boot from tape if your system is equipped with a VCP:

1. Mount the boot tape on Drive 0. Make sure the tape is at or beyond load point.

2. Boot PRIMOS II:

CP> SYSCLR

*** CPU VERIFIED ***

CP> BOOT 15

TRENAME= *DOS64

CP> BOOT 15 2

TRENAME = MIN19.4FD> *DOS64

PRIMOS II REV 19.1 11/22/82 (AT 170000)

OK:

3. If your master disk is intact, respond to the "OK:" prompt by starting up the master disk and attaching to its MFD:

OK: STARTUP pdev

OK: A MFD xxxxxx

OK:

In the example, pdev is the physical device number of the disk you wish to start up. If you need to remake and restore your master disk, continue with step 4 in response to the "OK:" prompt.

4. Press the ESCAPE key twice to return to Control Panel mode:

OK: <ESC><ESC>
>

5. Load MAKE:

> STOP

HALTED AT 154012: 003776

CP> SYSCLR

*** CPU VERIFIED ***

CP> BOOT 505

TRENAME= MAKE

HALTED AT 072427: 000001

CP>

6. Restart PRIMOS II:

CP> BOOT 170000

OK:

19.2

7. When the PRIMOS II prompt appears, start MAKE. Enter "S 1000" followed by the command line options to start MAKE. See Volume II of this book for information on MAKE.

```
OK: S 1000 -DISK pdev -PARTITION name
GO
**** MAKE <Rev. 19.2>
.
.
.
DISK CREATED
OK:
```

8. Load MAGRST:

```
OK: <ESCAPE><ESCAPE>
>STOP

HALTED AT 154012: 003776

CP> SYSCLR

*** CPU VERIFIED ***

CP> BOOT 505
TRENAME= MAGRST

HALTED AT 072427: 000001

CP>
```

9. Restart PRIMOS II:

```
CP> BOOT 170000

OK:
```

10. When the PRIMOS II prompt appears, start MAGRST:

```
OK: STARTUP pdev
OK: A MFD xxxxxx
OK: S 1000
[MAGRST Rev. 19.2]
.
.
.
***Restore Complete***
OK:
```

The contents of the boot tape can now be restored, or a backup tape can be mounted and restored. To run another PRIMOS II utility program from tape, repeat the procedure indicated in steps 5-7 (for MAKE) and 8-10 (for MAGRST). See Volume II of this book for a list of PRIMOS II utilities.

Booting From Tape on a Computer With a Control Panel

Use the procedure described below to boot from tape if your system has a control panel rather than a VCP.

Load PRIMOS II Into Memory: Follow the procedure below to load PRIMOS II into memory.

1. Mount the boot tape on Drive 0. The tape should be at load point or beyond.
2. Put the tape drive on line.
3. Set the sense switches to '15 (switches 13, 14, and 16 up; all others down).
4. Set the rotary switch to LOAD.
5. Press START. When the system types the "TREENAME=" prompt, enter the pathname of PRIMOS II exactly as it appears on the index of the magtape. Typically:

TREENAME= *DOS64

The system then responds:

PRIMOS II REV 19.1 11/22/82 (AT 170000)

OK:

6. If your master disk is intact, respond to the PRIMOS II "OK:" prompt by starting up the disk and attaching to its MFD:

OK: STARTUP pdev

OK: A MFD xxxxxx

OK:

In the example, pdev is the disk pack's physical device number. If you need to remake and restore your master disk, continue with step 7 when PRIMOS II issues the "OK:" prompt.

Load MAKE Into Memory: Continue with the steps below to load MAKE into memory.

7. Set the rotary switch to STOP.
8. Press MASTER CLEAR.
9. Set the sense switches to '505 (switches 8, 10, 14, and 16 up; all others down).
10. Set the rotary switch to LOAD.

11. Press START. When the system types the "TREENAME=" prompt, enter the pathname of MAKE exactly as it appears on the index of the magtape. Typically:

TREENAME= MAKE

The system halts with a '1 in the data lights.

Run MAKE: Follow the next set of steps to run MAKE.

12. Set the rotary switch to STOP.
13. Press MASTER CLEAR.
14. Set the sense switches to '170000 (switches 1 through 4 up, all others down).
15. Set the rotary switch to LOAD.
16. Press START. PRIMOS II responds with the prompt "OK:". Enter "S 1000" followed by the command line options to start MAKE. See Volume II of this book for information on MAKE.

OK: S 1000 -DISK pdev -PARTITION name

GO

**** MAKE <Rev. 19.2>

.

.

.

DISK CREATED

OK:

Load MAGRST Into Memory: Perform the following steps to load MAGRST into memory.

17. Set the rotary switch to STOP.
18. Press MASTER CLEAR.
19. Set the sense switches to '505.
20. Set the rotary switch to LOAD.
21. Press START. When the system types the "TREENAME=" prompt, enter the pathname of MAGRST exactly as it appears on the index of the magtape. Typically:

TREENAME= MAGRST

The system halts with a '1 in the data lights.

Run MAGRST: At this point MAGRST can be run by using the procedure given below.

22. Set the rotary switch to STOP.
23. Press MASTER CLEAR.
24. Set the sense switches to '170000.
25. Set the rotary switch to LOAD.
26. Press START. PRIMOS II responds with the prompt "OK:". Enter the STARTUP command with the disk device number of the master disk, then attach to the MFD on that disk and start at location '1000:

```
OK: STARTUP pdev
OK: A MFD XXXXXX
OK: S 1000
[MAGRST Rev. 19.2]
```

```

      .
      .
      .
*** Restore Complete ***
OK:
```

BOOTING PRIMOS OR PRIMOS II FROM A NON-STANDARD DISK

A standard boot consists of booting PRIMOS or PRIMOS II from the top partition of the disk mounted in Drive Unit 0 connected to the first controller (Controller 0). If you need to boot PRIMOS or PRIMOS II from any other disk on your system, you perform a non-standard boot.

Before you can perform a non-standard boot, you must first determine the desired actions of the boot. On systems with a VCP or Diagnostic Processor, these actions are represented using a boot number. This is the number you will supply on the BOOT command while in Control Panel mode, as follows:

BOOT number

On systems that use a Control Panel instead of a VCP, you will set the sense switches to the setting that describes the desired boot actions. You will then set the rotary knob on the control panel to LOAD, and press the START switch.

Performing a Non-standard Boot Using a Virtual Control Panel (VCP)

To perform a non-standard boot on a system that has a VCP or a Diagnostic Processor, you must first determine the boot number. Then, you enter the SYSCLR command to initialize the system, and the BOOT command with the boot number to start up the system.

The boot number is represented in octal. However, you do not have to understand octal to determine a boot number.

Basic Boot: The basic boot number is 114. This number specifies the following:

- The boot is to be performed from a disk
- The disk to be used is Drive Unit 0
- The disk drive is connected to the first controller (Controller 0)
- The operator is to be asked for the partition on which to find a copy of PRIMOS II to boot

Second Controller: If the disk to be used to boot the system is mounted in a drive connected to the second disk controller (Controller 1), add 20 to the boot number. This produces the number 134 if the second controller is to be used.

Note

A disk controller is sometimes identified by the device address of the controller. Device address '26 corresponds to the first controller (Controller 0). Device address '27 corresponds to the second controller (Controller 1).

Disk Drive Unit Number: To specify that a disk drive unit other than Unit 0 is to be used, look up the disk drive unit number in the following chart, and add the number to the boot number you have accumulated so far (114 or 134):

<u>Unit</u>	<u>Number to Add</u>
0	0
1	200
2	400
3	600

For example, to boot from Disk Drive Unit 2 on the second disk controller, you would have the boot number 534 (134 + 400) so far.

Partition Specification: If you were to use the boot number you have determined up to this point, the boot program would ask you for the physical device number of the partition from which PRIMOS II should be booted, as follows:

PHYSICAL DEVICE=

You would then enter the physical device number of the partition that contained the copy of PRIMOS II you wished to use. This is necessary if the head offset of the partition is not zero, that is, if the partition is not the top partition on the disk pack. (See Volume II of this book for information on determining physical device numbers.)

However, if you wish to boot PRIMOS II from the top partition of the same disk specified by the boot number, you can specify this in the boot number and avoid having to type the partition number. To do this, add 10000 to the boot number. For example, to boot PRIMOS II from the top partition of the disk mounted in Drive Unit 2 connected to the second controller, you would use the Boot Number 10534.

When you add 10000 to the boot number, you will not be asked for the physical device number of the partition from which to boot PRIMOS II. Instead, the top partition of the specified disk will automatically be used.

Booting PRIMOS: If you do not wish the boot procedure to automatically start up PRIMOS, you use the boot number you have at this point. If you do want PRIMOS to be automatically started up, the boot number depends on the partition that contains the version of PRIMOS you want to start.

Normally, the partition that contains the version of PRIMOS to be started is the same partition used to boot PRIMOS II. If this is the case, add 4000 to the boot number you have accumulated so far.

For example, suppose you want to boot PRIMOS from physical device 10664. This is a 2-head partition at Head Offset 2 on the disk mounted in Drive Unit 2 connected to the second controller. Therefore, you would use the Boot Number 4534. In response to the PHYSICAL DEVICE= prompt, you would enter 10664. PRIMOS would then be booted from this partition.

Another example is booting PRIMOS from Physical Device 462. This is a 2-head partition at Head Offset 0 on the disk mounted in Drive Unit 1 connected to the first controller. The boot number in this case would be 14314. No PHYSICAL DEVICE= prompt would be issued, because the boot number specifies that the top partition is to be used.

If you wish to boot PRIMOS from a different partition than is to be used to start up PRIMOS II, you cannot add 4000 to the boot number. This is because PRIMOS II would otherwise assume that PRIMOS is to be booted from the same partition used to boot PRIMOS II. Instead, you must start up PRIMOS II, and then manually start up the partition that

contains the desired copy of PRIMOS. To do this, you would use the STARTUP command in PRIMOS II. Then, you would issue the appropriate PRIMOS command to start up PRIMOS. (See Volume II of this book for information on the STARTUP and PRIMOS commands.)

Performing the Non-standard Boot: After you have determined the boot number, the actual boot procedure is performed by issuing the following commands:

```
SYSCLR
BOOT number
```

Substitute the boot number for number in the BOOT command. The boot will then be performed.

Performing a Non-standard Boot Using a Control Panel (CP)

To perform a non-standard boot on a system that has a control panel, you must first determine the setting of the sense switches. Then, you set the sense switches to this setting, perform a master clear, and start up the system using the rotary knob and the START switch.

Basic Boot: The basic sense switch setting is as follows:

Up	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Up
Down	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Down
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	

This setting specifies the following:

- The boot is to be performed from a disk
- The disk to be used is Drive Unit 0
- The disk drive is connected to the first controller (Controller 0)
- The operator is to be asked for the partition on which to find a copy of PRIMOS II to boot

Second Controller: If the disk to be used to boot the system is mounted in a drive connected to the second disk controller (Controller 1), set sense switch 12 to the UP position.

This produces the following setting if the second controller is to be used:

Up										-		-	-	-		Up	
Down	-	-	-	-	-	-	-	-	-	-		-		-	-	Down	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	

Note

A disk controller is sometimes identified by the device address of the controller. Device address '26 corresponds to the first controller (Controller 0). Device address '27 corresponds to the second controller (Controller 1).

Disk Drive Unit Number: To specify that a disk drive unit other than unit 0 is to be used, look up the disk drive unit number in the following chart, and set the corresponding sense switches up:

<u>Unit</u>	<u>Switches to Set</u>
0	None
1	9
2	8
3	8 and 9

For example, to boot from Disk Drive Unit 2 on the second disk controller, you would use the following sense switch setting:

Up										-		-		-	-	-	Up
Down	-	-	-	-	-	-	-	-	-	-		-		-	-	-	Down
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	

Partition Specification: If you were to use the sense switch setting you have determined up to this point, the boot program would ask you for the physical device number of the partition from which PRIMOS II should be booted, as follows:

PHYSICAL DEVICE=

You would then enter the physical device number of the partition that contained the copy of PRIMOS II you wished to use. This is necessary if the head offset of the partition is not zero, that is, if the partition is not the top partition on the disk pack. (See Volume II of this book for information on determining physical device numbers.)

However, if you wish to boot PRIMOS II from the top partition of the same disk specified by the sense switch setting, you can specify this in the sense switch setting and avoid having to type the partition number. To do this, set sense switch 4 up. For example, to boot

PRIMOS II from the top partition of the disk mounted in Drive Unit 2 connected to the second controller, you would use the following sense switch setting:

Up				-				-		-		-	-	-			Up
Down	-	-	-		-	-	-		-		-				-	-	Down
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	

When you set Sense Switch 4 up, you will not be asked for the physical device number of the partition from which to boot PRIMOS II. Instead, the top partition of the specified disk will automatically be used.

Booting PRIMOS: If you do not wish the boot procedure to automatically start up PRIMOS, you use the sense switch setting you have at this point. If you do want PRIMOS to be automatically started up, the sense switch setting depends on the partition that contains the version of PRIMOS you want to start.

Normally, the partition that contains the version of PRIMOS to be started is the same partition used to boot PRIMOS II. If this is the case, set Sense Switch 5 up. For example, suppose you want to boot PRIMOS from Physical Device 10664. This is a 2-head partition at Head Offset 2 on the disk mounted in Drive Unit 2 connected to the second controller. Therefore, you would use the following sense switch setting:

Up					-			-		-		-	-	-			Up
Down	-	-	-	-		-	-		-		-				-	-	Down
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	

In response to the PHYSICAL DEVICE= prompt, you would enter 10664. PRIMOS would then be booted from this partition.

Another example is booting PRIMOS from Physical Device 462. This is a 2-head partition at Head Offset 0 on the disk mounted in Drive Unit 1 connected to the first controller. The sense switch setting in this case would be as follows:

Up				-	-			-	-		-	-					Up
Down	-	-	-			-	-	-		-	-			-	-		Down
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	

No PHYSICAL DEVICE= prompt would be issued, because the sense switch setting specifies that the top partition is to be used.

If you wish to boot PRIMOS from a different partition than is to be used to start up PRIMOS II, you cannot set Sense Switch 5 up. This is

because PRIMOS II would otherwise assume that PRIMOS is to be booted from the same partition used to boot PRIMOS II. Instead, you must start up PRIMOS II, and then manually start up the partition that contains the desired copy of PRIMOS. To do this, you would use the STARTUP command in PRIMOS II. Then, you would issue the appropriate PRIMOS command to start up PRIMOS. (See Volume II of this book for information on the STARTUP and PRIMOS commands.)

Performing the Non-standard Boot: After you have determined the sense switch setting, the actual boot procedure is as follows:

1. Set the rotary switch to STOP/STEP.
2. Press and release the MASTER CLEAR switch.
3. Set the sense switches to the desired setting.
4. Set the rotary switch to LOAD.
5. Press and release the START switch.

GENERATING A MAGNETIC TAPE FOR EMERGENCY SYSTEM BOOTING

If your system has a tape drive or cartridge unit, it is good practice to make a boot tape. Such a tape contains a copy of PRIMOS II and enough utilities (such as MAKE and MAGRST) to allow a system to be restored following a complete loss of disk data.

To generate a boot tape, the BOOT_CREATE command is used. First, you build a text file containing a list of programs and directories to be written to the tape. This file can be created using a text editor such as ED or EMACS. Then, you invoke BOOT_CREATE and specify the name of the text file. BOOT_CREATE will read the file and generate a tape containing the programs and directories listed in the file. The resulting tape can be used to boot the system in an emergency situation.

The procedure for booting a system from tape is described earlier in this appendix. In addition, Volume II of this book contains complete procedures for restoring a system that has lost all of the data on its disks.

Use of the BOOT_CREATE command is summarized in the following example. A boot tape generated using the sequence of commands shown in this example should be sufficient for most installations. If you wish to know more about BOOT_CREATE, see Volume II of this book.

In this example, you will see the boot tape to be generated is mounted on Drive Unit 0.

19.2

19.2

OK, /* Build a list of files to be saved.

OK, ED

INPUT

DOS>*DOS64

CMDNC0>MAGRST

CMDNC0>MAKE

CMDNC0>COPY_DISK

CMDNC0>NSED

CMDNC0>FUTIL

(CR)

EDIT

FILE BOOT_LIST

OK, /* Now create the tape.

OK, BOOT_CREATE BOOT_LIST -MT 0 -NO_QUERY

The boot tape mounted on Drive 0 will be automatically created. See Volume II of this book for more information on BOOT_CREATE.

ERRORS

This section explains the error codes that may appear at the supervisor terminal or in the control panel data lights during a boot.

Disk Boot Errors

While BOOT is being loaded in from disk (using the input routine in Record 0), any errors detected cause a halt. The errors checked at this stage are the following:

<u>Octal Number in Lights</u>	<u>Error</u>
100	Parity
101	Machine check
102	Nonoctal physical device number
103	Bad device type
104	Bad status Storage Module, Diskette
105	Bad Record ID - Bad CRA (High-Low)
106	Incompatible <u>BOOT</u> records

Parity Error or Machine Check Error (100, 101): If a parity or machine check error occurs while the BOOT program is being loaded, a halt occurs with code 100 or 101, respectively. Parity and machine check errors are caught by the hardware. Additional information can be found in the diagnostic status word (DSWSTAT). After the memory test, the error message PARITY ERROR or MACHINE CHECK is displayed. If the errors persist, the messages persist.

Nonoctal Physical Device Number (102): The message OCTAL ONLY is displayed if you enter a nonoctal character for the physical device number. The PHYSICAL DEVICE= prompt is issued again at the supervisor terminal.

Bad Device Type (103): This code appears in the data lights if a device type of 7 is detected. The PHYSICAL DEVICE= prompt is issued again at the supervisor terminal.

Bad Status (104): Whenever bad status is detected, the status is stored in location '40. During the first phase, the loading of BOOT itself, a halt occurs with code 104. If a bad status is detected while PRIMOS II is being loaded, the message BAD STATUS appears, followed by the status word.

Bad Record ID (105): As each record is read, the requested record address is checked against the actual record address. If these addresses do not match, a halt occurs with code 105. The requested address is in locations '723 and '724 and the actual address is in locations '760 and '761.

When PRIMOS II is being searched for or loaded, the message BAD RECORD ID, rrrrrr rrrrrr ffffff ffffff appears, where the words indicated by rrrrrr are two words of requested octal address and the words indicated by ffffff are two words of actual octal address. The PHYSICAL DEVICE= prompt is issued again at the supervisor terminal.

Incompatible BOOT Records (106): The first and second records are checked to see if they come from the same version of the BOOT program. They may come from different versions if an old (control panel) CPBOOT (which always reads from Unit 1) gets the first record of a new (disk) BOOT. The new BOOT gets its second record from the unit designated by Sense Switches 8 and 9.

The second and subsequent records may come from a different version of BOOT. If such an incompatibility is recognized, BOOT halts with code 106.

'FILE' Not Found: If the required version of DOS or the DOS UFD is not on the requested physical device, the message 'FILE' NOT FOUND is displayed, where 'FILE' is the name of the requested file. The PHYSICAL DEVICE= prompt is issued again at the supervisor terminal.

Memory Test Failure: While memory is being tested, if the test patterns written and read do not match, the message MEM TEST MISMATCH LOC xxxxxx is displayed, where xxxxxx is the location of the word being tested. If either a parity error or a machine check is detected, the address of the word being tested is displayed, along with the message

PARITY ERROR or MACHINE CHECK. The PHYSICAL DEVICE= prompt is issued again at the supervisor terminal.

Tape Boot Errors

The following halt codes may appear in the data lights during a boot from magnetic tape:

000001	(Halt at '635 or '175175) The requested program has been loaded and auto-start has been suppressed (bit 10 of the pre-boot octal parameter set). On a machine without a VCP, press START and type START <address> to start the loaded program. On a VCP machine, perform an auto-start bootstrap and type START <address>. (At the halt, A, B, X, etc. were loaded from the program's save vector.)
072642	(Halt at '503) The pathname record for the requested file was not followed by a data record.
000003	(Halt at '641) The requested program cannot be loaded by the boot program: Its starting address is less than '6207 and its ending address is above the memory size minus '5423.
000005	(Halt at '440) The end of the logical tape was encountered before the requested program was found.
000021	(Halt at '260) Bit 11 of the pre-boot octal parameter was set, causing the boot to halt so that the SOC and OPTION A control words can be patched for a non-300 baud terminal.
xxxxxx	(Halt at '1) A tape read error or unexpected status condition occurred. The data lights display the last status word read from the controller. Status bit definitions are as follows:
100000	Parity error
040000	Runaway tape
020000	CRC error
010000	LRC error
004000	Low DMX range
002000	Permanent error
001000	Read-after-write error
000400	File mark detected
000200	Ready (OK)
000100	Online (OK)
000040	End of tape detected

000020	Rewinding
000010	Beginning of tape
000004	Protected (OK)
000002	Overrun
000001	Rewind complete

THE PRE-BOOT

Initiating the Pre-boot

On a computer with a VCP — after the power is turned on and the equipment is ready — the following message is printed at the supervisor terminal:

**** CPU VERIFIED ****

CP>

At this point, you initiate the pre-boot by typing the command `BOOT` followed by an appropriate octal value. For example, for the standard disk boot (from Controller 0), you type:

CP> BOOT 14114

On a computer without a VCP — after the power and equipment are turned on — you initiate the pre-boot in the following way:

1. Turning the front panel rotary selector switch to STOP/STEP
2. Pressing the MASTER CLEAR switch
3. Setting the control panel sense switches to the appropriate octal number
4. Turning the rotary switch to LOAD
5. Pressing START

The octal values supplied during a pre-boot have the same meanings on any Prime computer, whether they are entered through the keyboard (computers with VCPs) or through the control panel sense switches (computers without VCPs). The possible octal values and their meanings are discussed later in this section.

What Happens During the Pre-boot

19.2 | Prime computers other than the 9950 have either 256 or 512 16-bit words of PROM from which bootstrap programs can be loaded into main memory. The sequence of events just after you initiate the pre-boot is as follows:

1. PROM locations '0 to '50 are read into memory locations '6 to '56.
2. Execution begins (in 16S mode) at the address in location '7.
3. The A-register is saved in location '57.
4. Depending upon the octal value you have supplied, the appropriate bootstrap is loaded from PROM into memory.

19.2 | On the Prime 9950, the Diagnostic Processor loads the boot program from its online storage. This boot program only supports supported disks (including floppy disks) and magnetic tapes. After the program is loaded, it is executed. It will then load the next bootstrap program in from the selected device.

The Pre-Boot Octal Values

If your computer has a VCP, the octal number that you type in after the BOOT command consists of up to 6 digits. (BOOT xx is interpreted as BOOT 0000xx.) If your computer does not have a VCP, you enter the octal number in bit format through the control panel sense switches. Each of the 16 sense switches represents one bit. A sense switch in the up position represents a bit that is set (1), and a sense switch in the down position represents a bit that is reset (0). The leftmost digit can be 0 or 1; the other digits can range from 0 through 7. For example, the octal number '014114 would be entered on a non-VCP machine by setting Sense Switches 4, 5, 10, 13, and 14.

The rightmost octal digit (sense switches 14, 15, and 16) indicates what type of physical device contains the BOOT (or MTBOOT) program. (This digit therefore also determines which bootstrap program is loaded from PROM into main memory.) The eight possible values have the following meanings:

<u>Bit</u> <u>14</u>	<u>Bit</u> <u>15</u>	<u>Bit</u> <u>16</u>	<u>Octal</u>	<u>Meaning</u>
0	0	0	=0	Auto-start
0	0	1	=1	Obsolete (reserved for future use)
0	1	0	=2	Obsolete (reserved for future use)
0	1	1	=3	Obsolete (reserved for future use)
1	0	0	=4	Disk
1	0	1	=5	Magnetic tape
1	1	0	=6	Floppy disk (diskette)
1	1	1	=7	Reserved

A value of 0 reads in the auto-start bootstrap; a value of 4 reads in the disk bootstrap; a value of 5 reads in the magnetic tape bootstrap; and a value of 6 reads in the floppy disk bootstrap. The four possible values are discussed below.

Note

The first five digits of the octal number (bits 1 through 13) have special meanings that depend on your choice of last digit. The list below tells what bits 1-13 mean in each of the eight cases. A bit without an assigned meaning should be reset (0).

Auto-Start (0): Reads in the auto-start bootstrap. This bootstrap differs from the others in that it simply starts execution of a program that is already loaded into memory. Execution begins (in 64R mode) at the location specified in bits 1 to 10 (digits 1 to 4, representing locations '100000 to '177700). These bits become bits 1 to 10 of the starting address; bits 11 to 16 (digits 5 and 6) of the starting address are set to zero. If bits 1 to 10 are 0, a default starting location of '1000 is used. For examples of auto-start boots, refer to the section on the standard magnetic tape boot, later in this appendix.

Disk (4): Disks come in three varieties:

- Storage module disks, or SMDs (80MB or 300MB)
- Cartridge module devices, or CMDs (32MB, 64MB or 96MB)
- Winchester drives, also referred to as fixed-media devices or FMDs (58MB, 158MB, 160MB, or 675MB)

These disks all use 2080-byte records. The same BOOT values are used for all three.

Bits 10 and 13 of the BOOT value are always set. Bit 11 is always reset. Bit 12 is used to indicate which controller is to be used when reading the BOOT program from the disk. Bits 10 through 16 are summarized below.

<u>Bit</u> <u>10</u>	<u>Bit</u> <u>11</u>	<u>Bit</u> <u>12</u>	<u>Bit</u> <u>13</u>	<u>Bit</u> <u>14</u>	<u>Bit</u> <u>15</u>	<u>Bit</u> <u>16</u>	<u>Controller Address</u>
1	0	0	1	1	0	0	'26
1	0	1	1	1	0	0	'27

Record 0 of the first surface of Physical Drive 0 on the controller specified by bit 12 is read into memory starting at location '760 to allow for the 16-word header. Execution begins at '1000.

Bits 4 and 5 are defined as follows. If bit 4 is set (1), the BOOT program reads in PRIMOS II from the same device that the BOOT program itself came from. If bit 4 is reset (0), BOOT prompts for a physical device from which to read in PRIMOS II.

If bit 5 is set (1), PRIMOS is started up automatically by PRIMOS II. If bit 5 is reset (0), PRIMOS must be started by the operator, as described in Chapter 22. (For a description of how to start up PRIMOS, also see the chapter on system startup for the appropriate CPU.)

Thus, in a standard, automatic disk boot from a drive unit on Controller 0, the octal value is '014114 (Sense Switches 4, 5, 10, 13, and 14 set). This is one of the octal values given in the discussion of standard disk boots in the chapters on system startup.

This bootstrap waits until the disk drive is ready and retries if status errors occur.

Magnetic Tape (5): The bootstrap starts up the tape drive, ensures that the tape is set at a loadpoint, and reads one tape record into memory locations '220 through '777 (4K). Execution begins at '1000 via a JST '777 instruction.

The record read in by the bootstrap contains the MIBOOT program. When booting from magnetic tape, you may need to read in MIBOOT more than once, each time with different octal values. Use the instructions in the section on the standard magnetic tape boot later in this section as a guideline. Modify the octal values given there as necessary, using the information provided here and in the section on MIBOOT later in this appendix.

Bits 1-7 specify the number on the logical tape of the file to be loaded, the first file being Number 1. Calculating the position of a file on tape is easiest if the tape has been indexed by MAGSAV. The numbers of the files correspond to the order of files in the index. Note that if subdirectories have been saved, each subdirectory itself has a file on the tape.

If bits 1-7 are 0, MIBOOT produces the prompt "TREENAME=" and waits for you to supply the pathname of the file to be loaded. (See the section on MIBOOT for details on valid pathnames.)

Bits 8 and 9 control the relocation of MTBOOT, if relocation is necessary and if bit 13 is 0. (MTBOOT relocates itself out of the way of the program that is to be loaded, if necessary.) The following table shows how bits 8 and 9 determine the new ending address of MTBOOT:

Bit 8	Bit 9	New Ending Address of MTBOOT
0	0	End of physical memory
0	1	16K
1	0	32K
1	1	48K

If bit 13 is 1, bits 8 and 9 must both be 0. Relocation is then controlled by the A-register of the save vector of the program being read in, as explained below.

If bit 10 is 0, MTBOOT automatically starts the newly-loaded program. If bit 10 is 1, MTBOOT halts with a code of '000001 after loading in the program, and you must start the program yourself. (The halt code is displayed at the supervisor terminal or in the control panel data lights.)

If bit 11 is 1, MTBOOT halts at '260 to allow the SOC and OPTION A control words to be adjusted for a non-300 baud supervisor terminal. (300 baud is the default terminal speed.) The method for adjusting these control words is described in the section on MTBOOT, below.

Bit 12 selects between 7- and 9-track drives. If bit 12 is 0, a 9-track drive is assumed; if bit 12 is 1, a 7-track drive is assumed.

Bit 13 determines how relocation of MTBOOT will be controlled. If bit 13 is 0, relocation is controlled by bits 8 and 9, as described above. If bit 13 is 1, the new ending address of MTBOOT is determined by the A-register of the save vector of the file being loaded. In addition, if bit 13 is set, the SOC and OPTION A control words are copied into locations '1004 - '1006 before the loaded program is started. (Location '725 is always 0.) The save vector keys are copied into the save vector A-register. (This process emulates the action of the disk boot.)

If your computer has sense switches rather than a VCP, switches 8-10 and 12-13 must be left in position until the selected file has been loaded. The other switches may be reset any time after the pathname prompt has been issued or the tape search has started.

Floppy disk (diskette) (6): The bootstrap reads Record 0 (the first record of BOOT) into memory starting at location '770. To maintain IBM compatibility, the bootstrap alternately tries to read a 448-word PRIMOS record and a 64-word IBM record. Execution then begins at location '1000 via a JST '777 instruction.

The bootstrap waits until the drive is ready and retries if status errors occur.

Reserved (7): Intended as a user-supplied down-line loader. Currently, halts at location '57.

Keyed-in Substitutes for Control Panel Boots

If you ordered a Prime computer without the auto-load control panel PROM function, hand keyed-in programs are necessary. Because programs keyed in are likely to disappear after one use, these programs should be as short as possible.

THE BOOT PROGRAM ON DISKS

The BOOT program is placed on all disks by the MAKE utility. The source file is called BOOT.PMA and resides in the top-level directory FIXRAT on the master disk. The runfile resides in the MFD and is also called BOOT. BOOT occupies two records, Physical Record 0 and the record following the DSKRAT. The PROM bootstrap reads in the first record, which is itself a disk input routine that loads in the other record. On all other disks, BOOT occupies three records (record 0 and the two records following the DSKRAT).

When the BOOT program is read in from a disk, it performs the following functions:

- Cleans up parity, nondestructively, throughout memory.
- Sizes available memory.
- Initializes the supervisor terminal.
- Prompts you for the physical device from which to read in the operating system. (If bit 4 of the octal parameter is set, this step is omitted, and the operating system is read in from the device from which BOOT was loaded.)
- Attaches to the MFD on the specified device.
- Attaches to top level directory DOS.
- Reads *DOS16, *DOS24, *DOS32, or *DOS64 into memory and starts it, depending upon memory size and/or bits 1-3 of the octal parameter. (See the previous section.)
- Starts up PRIMOS, if bit 5 of the octal parameter is set.

Note

At Revision 16 and after, only *DOS64 is supplied; all other versions of PRIMOS II are obsolete. They are described here for archival purposes.

There are three possible outcomes of a boot operation: a successful boot, in which case PRIMOS II (or PRIMOS, if bit 5 is set) takes control; a detected error, in which case the boot returns to request which device to boot from; or an undetected error, such as nonexistent device, in which case the boot hangs. Error codes are discussed earlier in this appendix.

Once the boot has been successfully brought into memory by the pre-boot, it can be re-executed by pressing MASTER CLEAR (entering SYSCLR on a VCP machine) and starting at '1000. If a status error is detected on the device, BOOT restarts automatically, waiting until the device is ready.

Building BOOT on Disk

BOOT is stored as a normal PRIMOS II memory image (similar to a PRIMOS .SAVE file). The first record of the BOOT file is always physical record 0. The second record is placed elsewhere on the disk, depending on the size of the DSKRAT. Consequently, Physical Record 0 contains the following (in the order listed):

- A 16-word PRIMOS II record header, which points to the second record of the boot
- A 9-word PRIMOS II SAVE file header
- The first portion of the BOOT program itself

The record is read starting at location '760. The SAVE file header is as follows:

<u>Word</u>	<u>Address</u>	<u>Meaning</u>
0	'1000	Start address (SA = '3011)
1	'1001	End address (EA = '5103)
2	'1002	Program counter (PC = 0)
3	'1003	A-register (A = 0)
4	'1004	B-register (B = '1010)
5	'1005	X-register (X = '76)
6	'1006	Keys (K = '74006)
7	'1007	Reserved (0)
'10	'1010	Reserved (0)

Since execution starts at '1000, the start address must be '3011. This value is read into location '1000. The start address value of '3011 is also a JMP '1011 instruction, so the first instruction jumps to beyond the 9-word header. (BOOT is guaranteed to be executed in 16S mode either by MASTER CLEAR or the control panel PROM bootstrap.) BOOT executes in sector '1000 and so must be loaded there at runtime (at '1011). However, it must be saved so that the starting address is '3011 (the JMP '1011 instruction). To do this using the SAVE command of PRIMOS or PRIMOS II, the BOOT must actually start at location '3011, not '1011, in memory. Similarly, when the BOOT is loaded into memory using the RESTORE command, it will be loaded in memory starting at location '3011. Only the PROM bootstrap reads it in at '1011, where it can execute. It does not use the 9-word header, except to read it in at '1000 as part of the entire first record of BOOT.

Because BOOT can never be executed as a supervisor terminal command (it cannot execute in sector '3000), the PC, A-register, B-register, X-register, and Keys are available as constants to be used by BOOT. They have been defined as follows:

PC	= 0	Not used
A	= 0	Not used
B	= '1010	Option A master clear default control register
X	= '76	SOC master clear default control register 1
Keys	= '74006	SOC master clear default control register 2 Left byte ('170) = SOC control word 2 Right byte (6) = number of end-of-line delay characters. (This is not used by the bootstrap but is passed by PRIMOS II to set the supervisor terminal typewriter control words.)

Once BOOT has been placed on a disk, it can be copied to another disk with the following command sequence:

```
A MFD XXXXXX 0
RESTORE BOOT
A MFD XXXXXX 1
SAVE BOOT
```

Note

BOOT parameters can be changed to accommodate other terminal characteristics, either permanently by saving BOOT with new B, X, and Keys parameters or temporarily by patching locations '1004, '1005, and '1006 of the copy in memory. Be careful to change only one value at a time.

The ending address (EA) of the BOOT is not used by the PROM bootstrap; it tells the SAVE and RESTORE commands how long the BOOT file is (EA - SA + 1). Since the starting address (SA) of the BOOT file ('3011) is '2000 greater than the actual starting address of BOOT ('1011), the actual ending address is '2000 less than the ending address (EA) of the BOOT file ('5103), or '3103. Therefore, an executable BOOT image ('1011 to '3103) overlaps a saveable BOOT image ('3011 to '5103) in memory, making it difficult to save an executable BOOT image. It cannot be copied directly from '1011 to '3011. Because of this, use the RESTORE command to load the BOOT at '3011.

The file BOOT.SAVE is produced as a result of running the CPL file MAKE.BUILD.CPL. BOOT.SAVE is a copy of the boot exactly as it appears on a disk. BOOT.SAVE can be restored and saved in the same way in which the file BOOT in an MFD can.

THE MIBOOT PROGRAM ON MAGNETIC TAPES

Booting from magnetic tape involves more steps than booting from a disk. Tape boots start up PRIMOS II, but not PRIMOS; after a tape boot, you must start PRIMOS yourself. (For a description of how to start up PRIMOS, see the chapter on system startup for the appropriate CPU.) The standard instructions for performing a tape boot are listed earlier in this appendix.

The MIBOOT program is used to read a specified file from tape into main memory. You must know either the pathname of the file or its number on the logical tape being used. (If you do not specify a file number in bits 1-7 of the octal parameter in the pre-boot, MIBOOT prompts you for a pathname.) The file to be loaded must be in standard save-file format.

The MIBOOT program is saved by the MAGSAV utility in each logical tape header record of a magnetic tape. It is now possible to boot from any magnetic tape produced by MAGSAV Rev 14.1 or later.

When MIBOOT is read in from a tape, the following events occur:

- MIBOOT sizes available memory.
- If the terminal speed selection control words (the SOC and OPTION A control words) are to be patched, MIBOOT halts at '260 to allow you to do so. You request this halt by setting bit 11 in the octal parameter (see the previous section of this appendix). For instructions on making the patch, see below.
- If you have specified a file number in bits 1-7 of the octal parameter, MIBOOT searches to the end of the logical tape for the specified file.

If bits 1-7 are 0, MIBOOT issues a prompt for a pathname and searches to the end of the logical tape for the file you

specify. (The pathname you supply must be a series of up to 8 valid file system names — with no embedded blanks — separated by the greater than sign (>). If you enter a null line, a question mark, or any character whose value is less than '240 — for example, a control character — the prompt is repeated.)

In either case, if the file is not found, MTBOOT halts with the error code '000005 displayed at the supervisor terminal or in the lights.

- When the requested file is found, the first data block is read and the save vector examined. The file must have a starting address above '6207 or an ending address below the memory size minus '5423 ('172355 for system with 128KB or more). If necessary, MTBOOT relocates itself out of the way of the program being loaded, thus adjusting effective memory size. If relocation is necessary but impossible, MTBOOT halts with the error code '000003 displayed at the supervisor terminal or in the lights.

If bit 13 of the octal parameter is 0, relocation is controlled by bits 8 and 9, as described in the previous section of this appendix. If bit 13 is 1, relocation is controlled by the A-register of the save vector of the file to be loaded.

- If bit 10 of the octal parameter is set (1), MTBOOT halts with code '000001 displayed at the supervisor terminal or in the data lights. If bit 10 is reset (0), the program starts via a JMP instruction. If 13 is set (1), locations '1004 - '1006 are overwritten with the OPTION A and SOC control words.

If MTBOOT encounters an error when reading from the tape, it halts with the status word in the data lights or displayed at the supervisor terminal. The halt codes are explained in the last section of this appendix.

Loading From a Prime 300 7-Track Tape: The MTBOOT program must be manually started if it is loaded from a 7-track tape generated on a Prime 300. When the machine halts following the load from tape, start at '400. (Load '400 into location '7 and run.)

Loading From a Logical Tape Other than the First: To load from a logical tape other than the first, you must skip over the first logical tape. Do this by specifying a nonexistent file number or pathname. When MTBOOT halts with code '000005 displayed at the supervisor terminal or in the data lights, reset the switches (if necessary) and restart at '400.

Running on a Non-300 Baud Terminal: You can temporarily patch MTBOOT to accommodate your terminal if all of the following are true:

- The supervisor terminal is to be used to enter a pathname
- The supervisor terminal will not run at 300 baud
- MTBOOT has not yet been modified for the appropriate speed.
(See the section on modifying MTBOOT, below.)

If you set bit 11 of the pre-boot octal parameter before starting the boot procedure, MTBOOT will halt at '260 with '21 in the data lights (or displayed at the supervisor terminal) after sizing memory. You can then patch locations '220 - '222 as follows:

<u>Speed</u>	<u>'220</u>	<u>'221</u>	<u>'222</u>
110 baud	110	27	74006
300 baud	1010	76	74006
1200 baud	2010	373	34006
9600 baud	3410	3735	34006

After performing the patch, select RUN and press START to continue.

When booted in from tape, PRIMOS II also assumes a terminal speed of 300 baud. If bit 13 of the octal parameter is set, then MTBOOT copies its SOC and OPTION A control words into PRIMOS II, as in the case of a disk boot, so you do not have to do so yourself. If you do not wish to set bit 13, then you can reset the speed in PRIMOS II as follows:

1. When PRIMOS II (*DOS64) is being loaded into memory, set bit 10 of the pre-boot octal parameter. MTBOOT will then halt with '000001 in the data lights (or displayed at the supervisor terminal) after loading in PRIMOS II.
2. When MTBOOT halts, load '4000 into the A-register and set locations '1004, '1005, and '1006 to the appropriate values from the table above.

Note

Under PRIMOS II, the low-order 8 bits of '1006 also give the number of delays to be sent after carriage returns.

3. Press START. PRIMOS II resets the terminal to the desired speed.

This procedure is necessary each time PRIMOS II is reloaded from tape.

Modifying MIBOOT

The source of the magnetic tape boot program is MIBOOT.PMA. You may wish to modify the code for nonstandard tape buffer sizes or terminal speeds. Once the code is modified, you can reload it by running the CPL file MAGSR>MAGSAV.BUILD.CPL. This program rebuilds and installs MAGSAV (with the new copy of MIBOOT) in CMDNC0.

The supplied version of MIBOOT handles up to 4K-byte tape blocks. You can decrease the tape buffer size by decreasing the variable MOUNT in the source code.

The supplied version of MIBOOT initiates the supervisor terminal for a speed of 300 baud. If your supervisor terminal does not run at 300 baud, modify it permanently by issuing the following commands:

```
ATTACH MAGSR
ED MAGSAV.BUILD.CPL
FIND SA MIBOOT
REPLACE SA MIBOOT.SAVE 4/<value_1> <value_2> <value_3>
FILE
R MAGSAV.BUILD
```

Choose value_1, value_2, and value_3 from the table of patch values in the section on running on a non-300 baud terminal, above. Value_1 through value_3 corresponds to the values for locations '220 through '222, respectively.

MAGSAV Output Buffer: LBOOT.FIN assumes that the output buffer for the logical tape header record in MAGSAV is located at '4000. If the location of this buffer (OUTBUF) changes, the parameter OUTBUF in LBOOT.FIN should be changed to LOC(OUTBUF) + '14.

F

Uninterruptible Power Supply

INTRODUCTION

Some systems have an Uninterruptible Power Supply (UPS) capability. The UPS facility allows a system to continue running even when main system power is unavailable.

On the Prime 9950, support is provided for the UPS facility in the Diagnostic Processor. The Diagnostic Processor will recognize the loss of main power and the subsequent auxiliary backup by the UPS facility. It will also recognize when the UPS system will no longer be able to maintain system power and take appropriate action.

The Uninterruptible Power Supply interface provided by the Diagnostic Processor supports two configurations of the UPS system. One option involves using the UPS unit to power the entire processor system including all of the peripherals. The second option involves using the UPS system only to provide backup power for the CPU, memory, and Diagnostic Processor.

It is important that the system operator periodically check the UPS system to make certain that its battery is charged. An indicator lamp or meter should be present to indicate the status of the battery charge. If this lamp or meter indicates that there is insufficient battery power for handling a main A.C. power outage, notify your System Administrator immediately.

COMPLETE UPS FACILITY

When the UPS facility is powering the entire system, the Diagnostic Processor monitors the battery level of the UPS system, so that it becomes aware of a low battery condition. The low battery condition means that there are 5 or 6 minutes left before system power is lost.

Upon detecting this condition, the Diagnostic Processor will begin a system shutdown and will display the following message on the operator's console:

ERR402: Diagnostic Processor detects UPS low battery condition.
System shutdown in progress.
Refer to System Operator's Guide.

The Diagnostic Processor will then allow up to 5 minutes for the CPU to halt. If the CPU halts or the time expires, the Diagnostic Processor will print the following message on the supervisor terminal and power down the system:

WRN400: Diagnostic Processor shutting down system power.

LIMITED UPS FACILITY

When the UPS is powering only the CPU, memory, and Diagnostic Processor, the Diagnostic Processor system will provide the functionality needed to attempt to warm start the processor when main power returns if the power does return before the UPS batteries discharge.

When the Diagnostic Processor detects the UPS facility substituting for main power loss, the Diagnostic Processor will signal the central processor that a power failure has occurred and display the following message on the supervisor terminal:

WRN003: UPS System active, main A.C. power interrupted.
Refer to the System Operator's Guide.

The power fail signal will cause the processor to log the power fail condition and then halt. The Diagnostic Processor will continue to monitor the signals from the UPS system until main power is restored. At this point, the Diagnostic Processor will initiate a warm start sequence and print the following message on the supervisor terminal:

DPML01: Main A.C. power resumed, UPS no longer active.
System ready for Warm Start.

While the main power is unavailable and the Central Processor system is being backed up by the UPS system, the Diagnostic Processor will not accept any control panel commands in order to conserve power. Once the main power is restored, the Diagnostic Processor will once again accept commands.

System Configuration for Limited UPS

When main power is restored following a power loss, the Diagnostic Processor initiates a warm start sequence as described above. However, peripheral devices such as disks require some time following the restoration of power before they are ready to begin operating. The warm start logic of PRIMOS allows the System Administrator to specify the amount of time to wait following a warm start, so as to allow peripheral devices to come up to speed.

The amount of time to wait is specified using the UPS directive in the system configuration file, usually OMDNCO>CONFIG. A typical use of this directive would be as follows:

UPS 170

This would cause the warm start logic of PRIMOS to wait for 2 minutes (120 seconds = 170 octal) before referencing any peripheral devices.

For more information on this directive, see the System Administrator's Guide.

System Preparation for Limited UPS

To prepare a system so that it will automatically warmstart upon restoration of main A.C. power following a power outage, issue the BOOT command while in Control Panel mode, as follows:

BOOT

This command should be issued each time the system is powered on. It places the Diagnostic Processor in an automatic-warmstart state.

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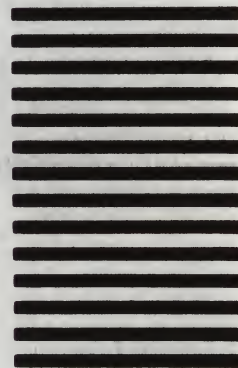
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